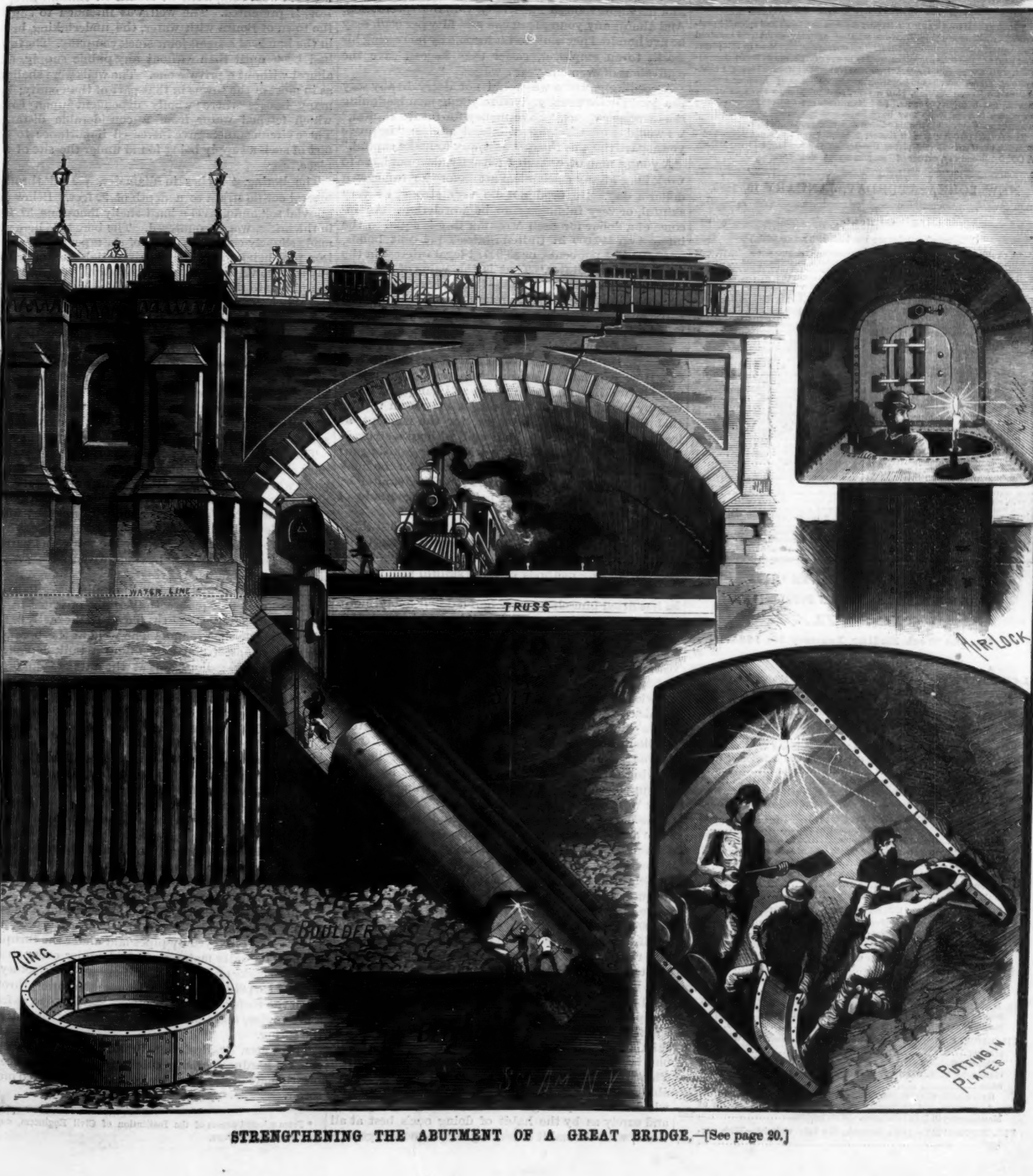
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LII.—No. 2. [NEW SERIES.] NEW YORK, JANUARY 10, 1885. [$3.20 per Annum. [POSTAGE PREPAID.]



STRENGTHENING THE ABUTMENT OF A GREAT BRIDGE.—[See page 20.]

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

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NEW YORK, SATURDAY, JANUARY 10, 1885.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 471,

For the Week Ending January 10, 1885.

Price 10 cents. For sale by all newsdealers.

THE YOUNG MECHANIC'S CAPITAL—HOW TO INCREASE IT.

The increase of capital as ordinarily reckoned—money saved and prudently invested—is not at present under consideration. Every workshop proves beyond the need of discussion that by industry, thrift, and the avoidance of wasteful habits, to say nothing of more reprehensible habits, it is possible for any, even the lowest paid, workmen to put by something, and thus, however slowly, accumulate a reserve which may be used as a money capital when opportunity serves. The industries of the country are so full of evidences of this fact, that it need not be insisted on here. Let us consider rather some of the means by which wage earners (particularly those whose mental and manual habits are not set by age) may increase their working capital more effectively and rapidly than by any possible saving of wage money. By working capital we mean whatever adds to the productive value of a man's time, and increases his income without requiring any increase in the duration or severity of his labor. The intelligence or trustworthiness which causes one laborer to be selected from a gang to oversee and direct the work of his mates, with an addition of half a dollar a day to his wages, is productive capital just as much as money at interest yielding an equal sum a day. From two to five years' earnings of our laborer, saved in bulk and securely invested, would add no more to his income than those qualifications which gained for him his slight though materially valuable promotion. And almost any young man can add fifty per cent, may be five hundred per cent, to his income by increasing his worth to an employer, easier than he can save the equivalent of even one year's wages.

Accordingly, while we would not decry in any way the good advice usually given to young men beginning life as wage earners, "Save money for future capital," we would emphasize this collateral advice: "Improve your spare time, as the quickest way to make capital."

A young man of ordinary capacity does not have to work long at any mechanical art before he can earn a dollar a day. He need not be very strong, or very skillful, or very intelligent to be worth that. An income of a dollar for each working day is equal to the interest on $10,000 in United States 3 per cent bonds, or $7,500 in 4 per cents, or $5,000 at legal interest in the majority of the States. That is the value of the common laborer's working capital—that is, his ability to do an average day's work at rough or unskilled labor three hundred days in a year, coupled with a willingness to do such work.

Our young mechanic, we will suppose, very properly aspires to be something better than an unskilled laborer. How can he most surely win promotion and a more liberal income? Tied down and hampered every way by the necessity of daily toil, it may seem to him that the doors of advancement, for the moment at least, are closed against him; and without a struggle to better his position he may drift along, waiting for an opportunity that may never come. Or he may quietly set to work to increase his working capital by trying to fit himself for a better paying grade of work.

This is usually the most obvious and the easiest thing to do. By steadily trying to do the work he has to do a little better or a little quicker, and by closely observing the working methods of more skillful men, he can usually add rapidly to his productive capital. When he has fitted himself to earn half a dollar a day more, he has accomplished as much as if he had increased his deposit in the savings bank by the handsome sum of $5,000. And his increased skill is quite as secure an investment and quite as well worth working for as so much money on deposit. So, too, a good handwriting or a knowledge of simple accounts, which any young mechanic can acquire by evening study and practice in a single winter, may easily secure his promotion to a position worth half a dollar a day more than he could earn as a mere laborer. A patient study of mechanical drawing furnishes a still more rapid means by which a young mechanic can increase his working value, in other words, his productive capital.

When our young mechanic has added to his knowledge and skill enough to make his services worth two dollars a day to an employer, he may fairly reckon that he has added $10,000 to his capital. And on this reasonable basis it is manifest that, of two young workmen of equal capacity, the one who—making no effort to improve himself—should have placed to his credit in bank $5,000 a year for five years, would not be so well fixed for life as his companion who should devote his spare time rigorously to the work of increasing his practical and technical knowledge of his trade and its associated arts, while endeavoring during his working hours to excel himself as a skillful and conscientious workman. A capital of $25,000 in cash is not to be despised; but it will not earn so much for a man as the knowledge, skill, and mental and moral discipline which our studious, faithful, and wide awake mechanic might acquire. There is nothing that men pay for more liberally than ability and sterling character; and there is no way by which these may be got and demonstrated so quickly and surely as by the habit of doing one's best at all times, with the habit of seeking useful knowledge during those hours of leisure which so many young men waste in idleness or worse.

The means most admirable for self-culture necessarily vary with the requirements of each seeker for such increase of working capital. A few are of almost universal utility, among them these: practice in writing and drawing, particularly drawing; the study of arithmetic and bookkeeping; the study of elementary physics, chemistry, and mechanics; critical observation of machines and mechanical processes; the careful reading of a paper like the SCIENTIFIC AMERICAN; independent experimental work, machine construction, and invention, and so on. Begin where you are, with whatever lies readiest at hand. With pluck, patience, and a determination to succeed, the most exacting and difficult arts and sciences have been mastered by men most unfavorably situated. And never forget that the habit of overcoming difficulties is the most valuable and productive element of any man's working capital.

Artesian Well at Bourn, Lincolnshire.*

BY JAMES PILBROW, M.INST.C.E.

The subject of artesian wells is not without interest to the engineer whose attention is chiefly directed to the supply of towns and other places with water. For this reason, the description of a small but productive artesian well, completed at Bourn in Lincolnshire, in 1856, is presented. The well was intended to supply the town of Bourn with water, the undertaking being in the hands of a small joint stock company. The town had been until then without any public supply, and almost without a private one. The wells were shallow, as in most of the towns in that part of the county; but many houses where wholly dependent upon carts, which fetched water from a considerable distance. These circumstances gave increased importance to the fact of such a supply being found under the site of the place.

The boring, 4 inches in diameter, passed through several oolitic strata to a depth of 92 feet. Below the alluvial soil and gravel a hard shelly limestone, 32 feet in thickness, was encountered. The bore hole here was made slightly conical to admit of the taper end of a cast iron pipe being inserted and driven tightly, to exclude any surface water, and to prevent water from the bore escaping into the gravel, and thus lose its full power to rise above the surface. The boring was then continued through various beds till it reached a stratum, 6 feet thick, of compact and hard rock, in passing through which, at 92 feet below the surface, the tool fell suddenly about 2 feet, evidently into a chasm or hollow, striking upon the hard surface of the underlying rock. The water immediately rushed up with great force, and drove the men from their work; and it was not without difficulty that the joints for attaching the curved pipe and sluice valve at the surface could be accomplished.

The site of the town of Bourn partakes of the ordinary character of the country, and is flat; the highest part, where the well is situated, being only about 6 feet above the general level. It had been the intention of the author, should the water rise with sufficient force, as he believed it would do, to supply the town direct from the boring, and in this way the work was carried out, the flow and pressure having proved even greater than was anticipated.

An air chamber was fixed at the well to regulate the pressure, and to equalize the supply of water to the town. The water rose at the Town Hall exactly 39 feet 9 inches above the ground. The yield at the bore and surface level, ascertained by filling a tank capable of containing 5,000 gallons, was at the rate of 567,000 gallons per day, and there was no diminution on letting the whole run continuously to waste. The yield was also tested by a "notch board," which, by using the coefficient 0·563, and measuring at still water and not at the "crest," gave 575,201·8 gallons.

The author knows of no other boring of like dimensions, either in this country or on the Continent, which yields so large a quantity of water, or where, the boring being made on the general level of the surrounding district, the water from which flows to so great a height above the ground.

It is needless to say that the town of Bourn has since enjoyed an unlimited supply of pure water without the assistance of engine, pumps, or reservoirs, and in far greater quantity than it requires.

The town of Spalding, several miles distant, has subsequently been supplied from the same source, the water being conveyed by pipes laid under the turnpike road. The water mains were laid under every street, with fire cocks at intervals, and it was satisfactory to all, and surprising to some, to see the water thrown upon the roofs of houses by a hose and jet pipe, as from a fire engine, and that only by the natural pressure of the spring.

The water, by Professor Brand's test, gave 19·4 degrees of hardness, arising chiefly from the presence of bicarbonate of lime; but by boiling it is rendered much softer.

* From selected papers of the Institution of Civil Engineers, copied from *Engineering News*.

Field of the Telephone.

Professor Bell is sanguine that the usefulness of the telephone has by no means as yet attained its natural limit. Since the recent decision sustaining the patents of the American Bell Company, he has been devoting himself with assiduity to experiments intended to improve the telephone, with the idea of making it feasible to speak over longer distances than is now possible. In a recent interview with a newspaper reporter, he predicted that it would in time be as easy "for a subscriber in New York to call up a friend in San Francisco, and to engage him in conversation, as it would be to call another subscriber to the telephone in the city of New York." The service between New York and Boston, by means of a circuit of double copper wire, is now said to be working very satisfactorily; but Professor Bell thinks that all wires in cities should be placed underground, that "the efficiency of the telephone cannot be fairly judged and tested in a large city, where the wires are supported on poles and buildings."

Prof. Bell does not believe in the relay system for strengthening the current along the line, but believes that the sound can be so intensified at the receiver as to be heard in the remote corners of a large room. As to this point, he says: "We find this difficulty—when the sound is intensified, it is at the expense of distinctness and of perfect articulation. This fault can probably be corrected in a measure, so that if persons desire it they will be able to sit some distance from the telephone and hear all that comes through the receiver. The transmitter can also be made to convey sounds brought to it from a distance."

Besides his direct experiments with the telephone, Professor Bell has long been actively interested in efforts to promote the education of deaf mutes. He has, in this connection, invented an instrument for accurately measuring the hearing capacity of the human ear. It is composed of one stationary and one sliding coil, between two horizontal rods, on one of which is a graduated scale reduced to the metric system. A telephone receiver is attached to the instrument, and the current is supplied by a magneto-electric machine which has a wheel composed of alternate sections of conducting and non-conducting surfaces, by means of which the current is rapidly and regularly closed and opened. A musical sound is produced, which the telephone receiver communicates to the ear. Holding the receiver to the ear, the operator moves the sliding coil from the stationary one, and as the distance between the coils increases the sound grows fainter and fainter, and finally is lost altogether. The scale on the side rod marks the point which the sliding coil had reached when the sound ceased to be heard. If a standard of normal hearing capacity can once be obtained, it will be an easy matter to measure the exact capacity of every ear which is tested. Every element, by the use of this instrument, is calculable.

Professor Bell has tested this instrument in some of the New York public schools, and estimates that ten per cent of the children attending them have slight defects of hearing. He says that "one per cent of this number are so deaf that they derive no benefit from the usual methods of instruction. The scholars know, of course, when their hearing is bad, but the teachers, as a rule, do not, and often think a child dull when it is only deaf. If the teachers were aware of the infirmity, and understood it, the pupil whose hearing was defective could always be given a position in the room and classes which would enable him to profit by the instruction which he is now, in many cases, losing. I find a great difference in the hearing capacity of people. Some persons can hear equally well with both ears, but most persons have a greater hearing capacity in one ear than in the other. The hearing capacity ranges from zero to an abnormal degree of acuteness."

Carbonic Acid Fire Extinguisher.

A new method of utilizing carbonic acid gas for extinguishing fire is now being introduced by Mr. Monch, of Berlin, several establishments in Berlin having been fitted with the apparatus. The system depends upon filling the room where a conflagration has commenced with a sufficient quantity of carbonic acid gas to suppress the flame. The apparatus consists of a wrought iron receiver of sufficient strength to resist a pressure of 250 pounds to the square inch, and which is filled with highly compressed carbonic acid. This receiver can at any time be charged by means of a battery of wrought iron flasks connected to it. Such flasks, filled with highly compressed carbonic acid, are a regular article of commerce in Germany, and when attached to Mr. Monch's receiver, the latter can be filled with the gas as desired at any convenient pressure. From the receiver branch pipes fitted with valves are laid to the different apartments it is desired to protect, and which can at any time be filled with the gas discharged from suitable nozzles fitted to the pipes. Smaller and independent reservoirs are also made which can be carried easily from place to place, and the contents liberated at any desired spot. In Germany, where fluid carbonic acid forms a large and increasing industry, Mr. Monch's system would naturally find favor, and at one of the places where it has been adopted—the varnish works of Mr. Krauthammer, of Berlin—its efficiency has been proved by the prompt suppression of an incipient fire, which is the special role of this class of apparatus.

A Papier Mache Floor Covering.

A new papier mache process for covering floors is described as follows: The floor is thoroughly cleaned. The holes and cracks are then filled with paper putty, made by soaking newspaper in a paste made of wheat flour, water, and ground alum, as follows: To one pound of flour add three quarts of water and a tablespoonful of ground alum, and mix this thoroughly. The floor is then coated with this paste, and a thickness of Manila or hardware paper is next put on. If two layers are desired, a second covering of Manila paper is put on. This is allowed to dry thoroughly. The Manila paper is then covered with paste, and a layer of wall paper of any style or design desired is put on. After allowing this to thoroughly dry it is covered with two or more coats of sizing, made by dissolving one-half pound of white glue in two quarts of hot water. After this is dry, the surface is given one coat of "hard oil finish varnish." This is allowed to dry thoroughly, when the floor is ready for use. The process is durable and cheap, and, besides taking the place of matting, carpet, oil cloths, etc., a floor thus treated is rendered airtight, and can be washed or scrubbed.

Hudson's Bay Route to Europe.

The prospects of a proposed route from the Canadian Northwest to Europe *via* Hudson's Bay are not considered encouraging. A diary for August shows that ice prevailed in the straits for nineteen days out of the thirty-one, and that snowstorms prevailed on five other days. As the straits ought to be open during August, the outlook for the other months cannot be bright. Mr. J. W. Klatze, a Dominion Government official, who was sent to inquire into the feasibility of constructing a railway from Winnipeg to Hudson's Bay, has returned to Ottawa. He does not speak favorably of the ultimate success of the undertaking, and thinks, if it is ever accomplished, it will be at a price which few capitalists would care to pay. Putting the difficulties of the navigation of the straits and the almost insurmountable barriers in the way of constructing a railway to the bay together, the outlook for northwest settlers having direct communication by this route with Europe is not at all hopeful.

Natural Gas.

Many interesting points came up during a discussion of a paper upon this subject read by Mr. William Metcalf before the Engineers' Society of Western Pennsylvania at its November meeting.

In regard to the waste of gas, it was said that more gas is being wasted within twenty-two miles of Pittsburg than is being used to-day. There is, on a close estimate, 65,000,000 to 70,000,000 feet of gas going to waste in the Murraysville district. Take, for instance, the Verner well, the Hukill well on the McWilliams farm, and the Hukill well on the Daum farm. There are three large and one small well going to waste. There are three large wells blowing the gas to waste in Washington County. There are three large and one small well going to waste in the Tarentum districts to-day—one there giving out gas at a pressure of fifteen to seventeen pounds, with the casing wide open." One great well near Wellsburg, W. Va., has been burning for years, the loss being estimated at $1,200 per day. These cases of waste form but a small portion of the whole.

Wells are being drilled every day, and this waste is expensive. A well which one year ago gauged to fully ten ounces pressure, mercury pressure, is to-day blowing not more than eight or eight and a quarter ounces. Although this difference seems trifling, the quantity of gas yielded is enormously decreased. The advantages to be derived by the proper consumption of this gas may be inferred from the following: "The idea of blowing 50,000,000 cubic feet of gas away in a day right along, and then complaining that our competitors are selling iron cheaper than we can make it, and we not using this gas! One cause of the decrease in the flow is attributed to the pores of the rock becoming choked with incrustations of salt and "gas dust." Blasting with light charges of nitro-glycerine might be of use, as a greater area with new pores would present themselves for the exit of the gas; but in the case of wells about Pittsburg it is necessary in blasting to make sure that the gas rock stratum is not so much shattered as to admit water from the salt water veins below." Pieces of rock have been brought up to the surface [from blasted wells], and on the pieces you find little barnacles, or rather a substance looking like barnacles. You see a large hole next to the rock, and a little lower another one somewhat smaller, and then get smaller and smaller until it forms a cone, and the last layer of that cone closes it up entirely." In some wells that get plugged it is found that in the rock next to the shell the holes are closed by paraffine. There is no way of stopping it when the ocean of salt water under the gas veins gets broken into; this is known among drillers as the Atlantic Ocean, because analysis of it shows it to be of very nearly the same composition as the ocean itself.

Waste of gas has been stopped by the wells being plugged, but the task is a difficult one, and the result is not always successful. Therefore the pertinent question came up: "Could not some of our mechanical engineers invent some sort of a tap pipe with a sliding valve on it that could be left out when the gas was struck, so that the pipe would be enabled with the valve to prevent the waste?" The reply was that this had been tried, "and the only success it met with was to bore a hole through the top of the derrick." So far all the valves have been made for the casing, and the idea was advanced to have a heavy pipe for the top, and arrange the valve so as to use it or not, as required. The plan of stopping the drill before entering the gas stratum was cast one side, since in undeveloped districts there would be no certainty that the gas could be obtained when needed, by simply completing the bore.

In addition to its use in the manufacture of iron, it is believed that natural gas will soon be largely employed in the making of glass. The operation of annealing, now so difficult and troublesome, could be soon perfectly performed with the aid of natural gas, since it can be so utilized that it can be shut off so easily and gradually as to let the molecules of the glass come to their normal position without strain.

Another application of this gas is to the manufacture of very thin sheets of metal, either iron or steel, where the difficulty is in pickling the scale off in order to get a fine finished surface. By a process for which a patent has been asked the annealing box is brought to the requisite heat by the use of natural gas, and then a pipe, connected with the box, turns in a stream of the gas when the metal is hot enough, and allows it to pass through. The box is kept hot for some little time and is then cooled gradually, when the plates come out perfectly clean—as clean as tin, but not so bright.

Steel Bridge in South Africa.

The first steel bridge in South Africa, and the first bridge in the Orange Free State, was recently built over the Caledon River between Smithfield and Rouxville. It is of the bowstring type, is in four spans 650 feet long, and the total length, including approaches, is 1,200 feet. It stands 50 feet above low water mark, and the lowest part of the superstructure is 10 feet above the highest water mark ever known. The piers are 12 by 30 feet, are of stone masonry laid in cement, and rest on solid rock. The whole weight of the superstructure is 350 tons including all necessary timber. It was erected on a staging made of steel wire ropes, one inch in diameter, stretched from pier to pier, with wooden trestles on top to make up for the sag caused by the weight of each span. This method worked admirably, and the structure was completed without hitch or accident of any kind. The bridge cost $160,000, including $5,500 duty paid to the colonial government for material; it was built by Messrs. Scrimgeour Bros., of Port Elizabeth, to whom we are indebted for the foregoing particulars.

Automatic Car Couplers.

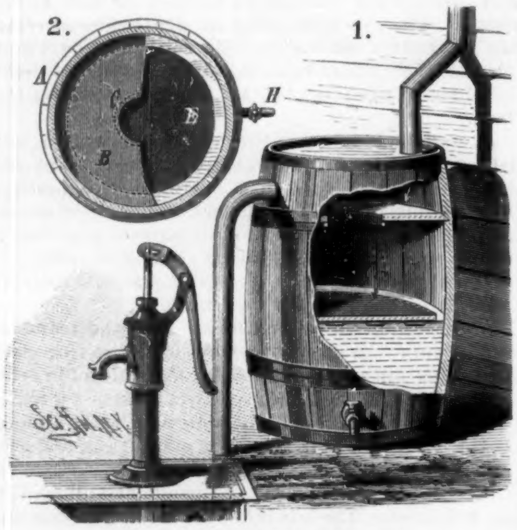
As the result of recent examinations, the Railroad Commissioners of the State of Massachusetts recommended for adoption by the companies of the State either one of the following self-acting couplers: The Ames (hook link), U. S. (link and pin), Cowell (hook), Janney (hook), Hilliard (hook). At a recent meeting of delegates appointed by the managers of the railways of the New England States, sixteen roads and six States were represented, namely, Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut, in all fifty-six votes. After considerable discussion and voting, the preference of the delegates finally settled upon two of the above couplers as the best for general adoption. These were the Ames and the Cowell couplers, each of which received 22 votes, or 44 in all—12 votes not being cast. Illustrations of these couplers will be found in SCIENTIFIC AMERICAN SUPPLEMENT. A resolution was passed calling for a national convention of railway representatives to consider and decide upon the best form of automatic coupler for general adoption.

The American Exhibition, London, 1886.

The above is the designation under which an exhibition is announced to open in London in May, 1886. It is intended to be so arranged that a visitor on entering will be reminded of the approach to this country through New York harbor, and thence taken in imagination by successive stages to the most prominent objects usually sought by sightseers, including a "trip across the continent," the whole being so arranged as to exhibit the arts, manufactures, products, and resources of the United States, of every kind, from the broker's office in Wall Street to the camp fires of Nevada. Applications are said to have been already made for considerable space in this unique exhibition from prominent American manufacturers and patentees. Mr. John R. Whitley is the Director-General, and Charles B. Norton, Secretary, 7 Poultry, London, E. C.

CUT-OFF FOR CISTERNS.

A tank, such as a barrel, is provided at about six inches from its top with a transverse partition, B, formed with an aperture, C. The leader from the roof is held in the top of the tank. Below the partition is the float, E, adapted to close the aperture. An overflow pipe leads from the upper part of the barrel to the cistern, and the lower part is provided with an outlet cock. The water flows into and collects in the bottom of the tank, and as the level of the water rises the float rises, and finally closes the aperture by being pressed by the water against the under side of the partition; the water then flows into the cistern. The water first



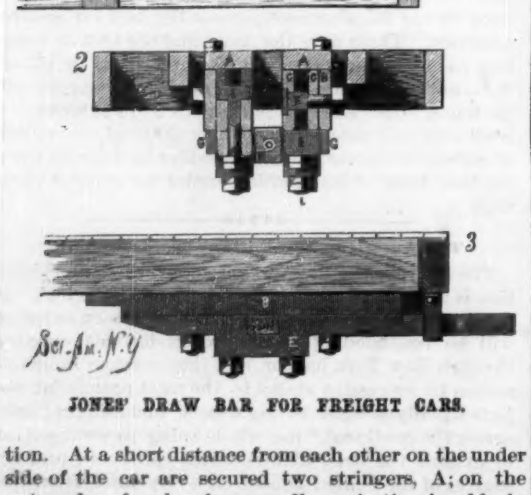
TROY'S CUT-OFF FOR CISTERNS.

collected contains all the impurities that were on the roof and only the clean and pure water passes to the cisterns. When it stops raining, the water in the tank can be drawn off through the cock. Since the quantity of water required to collect the impurities varies in different localities, by using one or more receptacles connected by a pipe to the one containing the cut-off the storage room for the impure water can be indefinitely increased, so that only pure rain water will flow to the cistern.

This invention has been patented by Mr. Daniel S. Troy, of Montgomery, Alabama.

DRAW BAR FOR FREIGHT CARS.

The engraving shows an improved draw bar for freight cars—recently patented by Mr. William A. Jones, Post Office Box 715, Delaware, Ohio—which can easily be repaired and removed or replaced without requiring the parts of the car to be taken apart. Fig. 1 is a plan view of the under side of the draw bar; Fig. 2 is a cross sectional elevation; and Fig. 3 is a longitudinal eleva-



JONES' DRAW BAR FOR FREIGHT CARS.

tion. At a short distance from each other on the under side of the car are secured two stringers, A; on the outer edge of each a downwardly projecting jaw block, B, is held by four screw bolts, L. On the inner side of each block are held two plates, C, each pair being held apart by the upper squared portions of the bolts between the plates. The middle bolts are longer than the end ones and project further down, and the lower ends of the bolts pass through plates, E, placed horizontally against the bottom of plates, C, of one pair. Between the middle bolts two transverse bars, G, are placed edgewise on the plates, E, the ends of the bars being in pockets below plates, C. Between the transverse bars is arranged a spiral spring (Fig. 3) which is coiled around a spindle projecting from the rear end of the draw head, K, which is supported by a cross piece secured on the front ends of the blocks, B, and plates, C. A band, H, secured on the top and bottom surfaces of the draw head at its inner end, is passed over the two cross bars, and at its vertical cross piece is provided with an aperture through which the spindle can pass. The spring acts as a buffer both when the draw bar is pulled or pushed, and the strain is transmitted by the cross bars to plates, E, and then to plates, C, and the stringers. The plates, C, are held together by bolts, F, and the stringers are braced by cross pieces. If the draw head is to be removed, it is only necessary to remove the nuts, when the plate, E, and cross bars, G, drop; a new draw head can then be fastened, and held on the bottom of the car very easily and rigidly.

The Cholera Germ.

The cholera bacilli of the Asiatic cholera appear to be something unique, identical, and unlike any other known or described species. It is exceedingly small, and much smaller than any other form of bacilli, being more obtuse and comma shaped, with a single spore in its larger end at the time of maturity. At first, when inhabiting the mucous corpuscle (which is the home of the germ) it is more regularly oval or elliptical, existing in chains or chaplets end to end, as seen in the outer edges of the rounded and oval mucous corpuscles and broken parts of same. Inside the corpuscles they are more broken up, yet usually form short lines or chains. They multiply by transverse division (across the middle) very rapidly, and completely fill the corpuscle, bursting it at last, at which time the bacilli are set free, become motile, and take on the peculiar comma-form appearance. This is also its time of maturity, at which time the spore may be observed in the enlarged end opposite the curved and shortly pointed end.

Their size at first, in the corpuscle, is about one twenty-five-thousandth inch long by one fifty-thousandth inch broad, afterward about one twenty-thousandth by one thirty-thousandth inch, which is bordering on the size of micrococci.

They readily take the aniline staining, and to be seen well require a high-power objective with a magnification of at least fifteen hundred diameters. A slide was prepared by one of Koch's assistants, who placed the cover on the mucous lining membrane of the intestines of a cadaver in Calcutta, and was kindly sent by W. J. Simmons, of that place, to J. M. Adams, of Watertown, N. Y., who gives us the figure and substance of the above article.

Vapor of Glycerine for Coughs.

According to an account in the *Gazette Medicale de Nantes*, M. Trastour has employed with great advantage the vapor of glycerine whenever a distressing or frequent cough has had to be alleviated. The remedy is very simple in application. About fifty to sixty grammes of glycerine are heated in a porcelain capsule by means of a spirit lamp; a large volume of vapor is thereby disengaged, and should be breathed by the sufferer. Glycerine in which carbolic acid has been dissolved may also be employed. The cough of phthisis and the irritation in the throat of many complaints afford proper trials for these remedies.

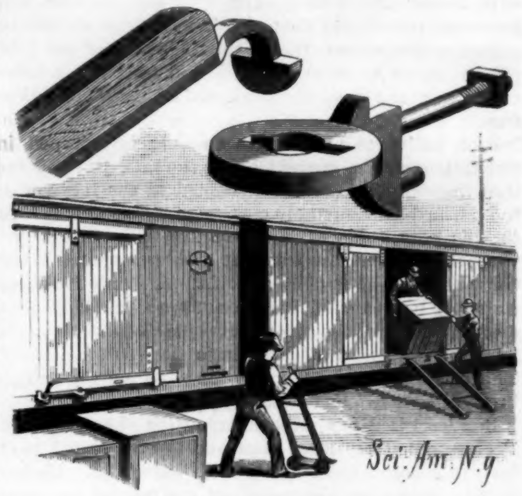
IMPROVED SAFETY VALVE.

The body of the valve, which is of cylindrical form, is made with a thread at one end for its attachment to a boiler, and the outer end is closed by a screw cap, Fig. 2, having in it a circle of holes for the escape of steam. Within the body, a short distance below the cap, is an annular flange that has its upper edge grooved and beveled to form a seat for the disk valve, which is made with a stem extending to near the lower end of the body, so as to give access to the nuts for tightening the spring; it also has a guide stem extending into a recess in the cap. Around the stem is a bridge having arms that take beneath the flange; and on the lower end of the stem, above the adjusting nuts, is a similar bridge. The bridges serve to retain the stem and valve central, and the upper one is a cap for the spiral spring which is around the stem, and rests on the lower bridge. The cap is made with a groove beneath the holes, for holding the steam or preventing it from passing to the guide recess of the stem. The valve being put together, the adjusting nuts are screwed up to give tension to the spring according to the pressure at which the valve is to open. The body is then screwed into position, when the tension of the spring cannot then be changed without unscrewing the body from its place. In operation the valve rises as soon as the pressure upon it is sufficient to overcome the spring, and the opening allows the steam to escape freely.

This invention has been patented by Messrs. Theodor Falk and Alexander Frazier, whose address is P. O. box 166, Maywood, Ill.

FREIGHT CAR SKID.

In the sill of a car a series of bolts is held below the door, on the outer end of each of which is formed a flat eye provided with a slot parallel with the sill and having an enlargement in the middle. A short distance each side of the door opening is secured a hook, on the outside of the car near the bottom, which serves to hold the outer ends of the skids. Each skid is provided at one end with a bar having its outer end bent rectangularly and having a transverse head formed with a rounded edge on the bent part, the head being at right angles to the length of the skid. When not in use the skids are held in the hooks against the sides of the car, and as the heads are at right angles to the slots, and below the



ROWE'S FREIGHT CAR SKID.

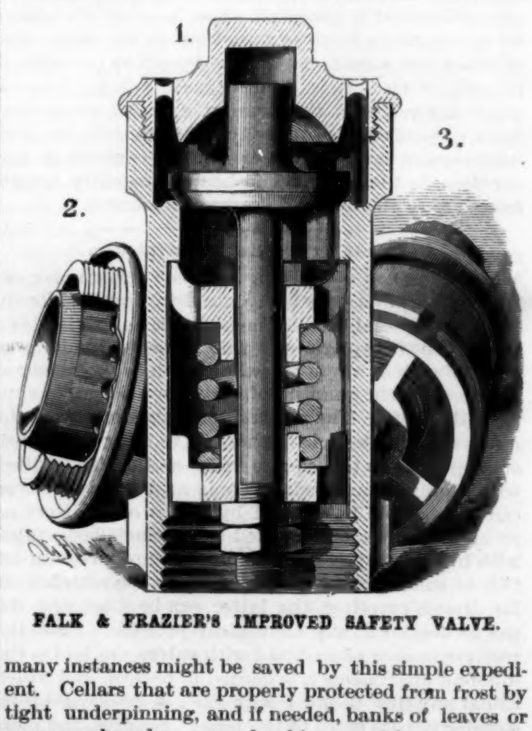
flat eyes of the bolts, they cannot be thrown out by the jolting of the cars.

When the skids are to be used, they are lifted out of the hooks and swung from the car and the free ends rested on a wagon, or on the ground, platform, etc. When in this position the hook ends of the bars can be lifted out of the eyes and placed from one eye into another. The bolt is prevented from turning by the stud on the back of the eye. The skid is automatically fastened in the hook by means of a tumbler.

This invention has been patented by Mr. Joseph L. Rowe, of Corydon, Indiana.

To Keep Cellars from Freezing.

A cheap and very effective way to raise the temperature in a cellar that is dangerously near the freezing point is to set one or more common kerosene lamps on the cellar bottom during the day time, when not wanted for lighting the rooms above. We have all noticed how much warmer a living room is in the evening, when the lamps are burning, than in the day time with the same amount of fire in the stoves or furnaces. All the heat from a burning lamp is retained in the apartment. Twenty-five cents' worth of kerosene oil will throw out a suprising amount of heat, and in many cases it would be the cheapest means for keeping a cellar from freezing during the passage of an extra cold wave. Cold waves may spoil a winter's store of vegetables, which in



FALK & FRAZIER'S IMPROVED SAFETY VALVE.

many instances might be saved by this simple expedient. Cellars that are properly protected from frost by tight underpinning, and if needed, banks of leaves or evergreen boughs, or even banking up with snow, rarely freeze during the coldest weather in winter, but sometimes an unusual cold snap, or a long continued period of cold, may endanger the potatoes and other stores even in pretty tight cellars, especially if plenty of fires are not kept burning in the rooms above.

HENRY MORTON STANLEY.

August Peterman speaks of Stanley as the Bismarck of African explorers. It is a fact that the results achieved by this American in Africa surpass all the scientific discoveries made during the last thirty years, all travels of Europeans during the last eighty years, and the travels of the Arabians during the last thousand years. Stanley has acquired more knowledge of Africa than millions of the inhabitants possess of their own country. History knows of no other discoverer who has been as successful as Stanley.

Stanley's first trip to Africa, and the finding of Livingston, created a great sensation throughout the civilized world. He had no special object in view during his second journey, and at the time that he embarked on a small boat on the African stream Lualaba, and drifted toward the north. Shortly before leaving Njangwe, on October 30, 1875, he wrote as follows:

"The entire equatorial Africa is an unknown country, from which not even the slightest information has passed to the outer world. Even here in Njangwe no one knows anything of the same. It is wrapped in mysterious darkness, and the great superstition of the inhabitants has surrounded it with horrible imaginations. They are of the opinion that it is inhabited by vicious dwarfs striped like the zebras, living on elephants, and using poisoned arrows. An immense forest extends toward the north, no one knows how far, as no one has seen its end. Day after day, and week after week, the traveler passes through the forest of equatorial Africa without ever seeing the sun. The great Lualaba River flows to the north, and it is supposed that it extends to the Mediterranean Sea; at least, so the Arabs and their slaves say."

From the above it is evident that much courage was required to undertake the hazardous trip to this unknown country, but Stanley succeeded after overcoming enormous difficulties, dangers, and hardships. He has proved that the Lualaba and the Congo are identical, and has thus solved the last problem of the two main rivers of Africa, the Nile and the Congo.

Stanley achieved much because he did not travel as a scientist collecting notes, or as a great discoverer, but as a general and conqueror. He negotiated where he could accomplish the desired result thereby, but otherwise made use of his weapons. Cortez and Pizarro received much assistance, in the countries they conquered, from those who were suppressed and ill treated, or dissatisfied with the rulers, but Stanley received no assistance whatever, and it was all he could do to prevent being attacked. Stanley not only achieved scientific results, but also discovered a beautiful river and country for mercantile transactions. Enormous woods of oil palms, cotton plants, rubber trees, etc., cover this country. Elephants seem to be in abundance, for Stanley says that he not only saw temples and buildings made of ivory, but even the most common implements, which are not usually made of such costly material. Some of the inhabitants are cannibals, but some tribes are partially civilized and have some culture. Stanley found very large cities and some vessels of perfect construction. The Congo countries are very fruitful, and the climate is favorable to vegetation, although the coast climate is not very favorable for Europeans. The country is specially well adapted for raising tropical fruits, and most of the West Indian plants can be raised here, such as cotton, sugar, indigo, tobacco, cocoa, ginger, and many others. The quantity and number of drug plants of this country are enormous.

The annexed portrait of Henry Morton Stanley was taken from the *Illustrirte Zeitung*.

HENRY MORTON STANLEY.

The Box Psylla Found in the United States.

While making some observations for the Bureau, Mr. A. Koebele found toward the end of May, in the garden of Mr. Angus, New York city, large numbers of a flea-louse infesting box (*Buxus sempervirens*). The insect—at this time mostly larvæ and pupæ and a few imagos—thickly crowded the young growth of the plants, and the whole hedge showed at the first glance a sickly appearance, the tender shoots being more or less yellowish in color and evidently dying. In our breeding cages the imagos continued to develop throughout the month of June, but outdoors no further observation on the life history of the insect could be made. The species proved to be identical with the European box psylla (*Psylla buxi* Linn.), a species hitherto not known to occur in America. It is of a pale green color with hyaline wings, the anterior and middle portions of the thorax (pronotum and dorsulum) having brownish longitudinal markings, the larva and pupa being of still paler, uniform greenish color, and not deviating in form from the larvæ of other species of the same genus. The winged insect bears a deceptive resemblance to our native hornbeam psylla (*Psylla Carpini* Pitch), and can only be distinguished from this upon close examination, the most obvious difference being the absence of a distinct pterostigma in the box psylla.

Mr. Angus attempted to brush the psyllas off with a stiff broom, but this is a remedy of very questionable value, and a much simpler and doubtless more effective way of getting rid of this pest would be the application of diluted kerosene emulsion in a very fine spray.

There is no danger that this newly imported psylla will infest any other plant besides the box, but, if not kept in check, it is liable to spread and to do serious damage to the plant in all those sections of the country where it is grown and esteemed as an evergreen ornament.—*Prof. C. V. Riley, in Ann. Rep. Dep. Agr.* 1884.

The Future of Natural Gas.

The application of this fuel at Pittsburg and vicinity is watched with an abiding interest. With gas at fifteen cents per thousand feet, it is not strange that manufacturers should be eager to avail themselves of so cheap a fuel, so cleanly in use, so readily applied and controlled, and, in many of its applications, furnishing a superior product. The present excitement in gas territory is not unlike the early oil days, and a general rush to utilize it seems only to be prevented by a dazed sort of conservatism which awaits further developments. Meantime, prospectors are sinking new wells, pipe line companies are organizing, and law suits have been initiated, a sure sign of serious purpose, while millions of cubic feet are daily wasted. The possibility of early exhaustion seems to be the only deterrent influence on the general alteration of plant for its use among enterprising manufacturers. The marvelous thing in it all is that this product should have been going to waste for a full generation without a systematic attempt for its utilization.

We predict for natural gas a future as great as that which grew out of the early petroleum development, and of larger and more widespread industrial value. Even were the production of gas as fickle as that of oil, the product of wells as variable and short in duration, its value would still warrant its collection by pipe lines, with the same certainty of an aggregate average yield, with due enterprise, certainly adequate for those purposes to which it is pre-eminently adapted, even though it should prove insufficient for general use. But the history of wells does not augur any such unreliability. Many have roared gas steadily for fifteen years.

Gas is also far more widely distributed than oil. While a usual accompaniment of oil bearing formations, it exists in abundance in other formations where oil has not been found. The general prevalence of gas springs in the Hamilton shales of Western New York led to the sinking of many oil wells in 1866-68, which however never developed more than a plentiful supply of gas. One of these wells, in West Bloomfield, N. Y., has been a roarer for eighteen years, and we believe still roars with undiminished vigor. As these shales run through to the west on that general latitude, the gas is no doubt widely distributed outside of the oil formations. It is presumed also that other formations may prove gas-bearing.

It is this wide distribution of gas which will give it a more general industrial value. Local gas belts, when some permanency of supply is assured, will be so many mines of power, which will determine the location of manufactories as water-power has in the past. It will be gathered up into mains and forced to points more or less distant, and, if pressure be insufficient, pumps or steam jets, as in the pneumatic tubes of London, will force it to its destination. Perhaps to greater distances still, its energy may be transmitted by electric conductors.

That the supply is infinite, or incapable of exhaustion, is not to be anticipated. That it will be exhausted in the immediate future, we greatly doubt. In any event, its use should be jealously guarded, and the wasting of it looked upon as criminal, and made the subject of legislation. No man holding a spot of land on which a well has been drilled has any more right to idly blow the gas out of a belt than he would have to cut a levee and flood thousands of acres belonging to other people, simply because he built the levee and it is on his own land. To idly burn the gas is destroying property of great value, and in which the community has an abiding interest; in fact, it is a species of arson. The obligation of the state to the future should prevent needless and heedless waste when proprietors do not find it for their self-interests, the more especially as the cost to producers would be so slight, and any sentiment which defeats such regulation is mere wantonness.

The uses to which gas may be put are practically limitless. To all metallurgical purposes, glass making, brick burning, and similar uses, it is pre-eminently adapted. For household purposes it will prove a boon, and greatly conduce to domestic felicity. If charged with oil it is equal to any illuminant, though in its natural state by no means uneconomical. If it results in making of Pittsburg a clean, smokeless city, every outside barbarian who has occasion to visit that benighted town will rejoice with great fervor. A clean, whitewashed rolling mill would be a phenomenon to delight the eye, yet we understand that such a thing already exists in Pittsburg.

Ironmasters who expect it to furnish an escape from the threatened deluge of cheap Southern iron may be disappointed, as it may prove equally prevalent in the iron regions of the South. Wherever it exists, it will certainly greatly cheapen all metallurgical and manufacturing operations, and, should it prove to be widely prevalent and reliable, the cost of production would be generally so lowered as to enable competition in the markets of the world.—*The American Engineer.*

Idle Ship Builders in England.

The number of workmen out of employment on the banks of the Tyne, between Newcastle and Tynemouth, is estimated to be between 10,000 and 12,000. It is reckoned that the amount of money withdrawn from the local banks for the payment of wages in the several shipyards and factories on the Tyne is less by £15,000 a week than it was a year ago. In Newcastle upward of 1,600 families are regularly in the receipt of relief, involving a weekly expenditure of about £240, while in addition to this, free breakfasts and dinners are given daily to about 900 children. Immense quantities of second-hand clothing have also been distributed among the poor, and the Relief Committee are making preparations for the distribution of coals during the winter months, several local colliery owners having presented quantities of coal for disposal. At Jarrow there are 955 families receiving relief, and free dinners are given daily to nearly 1,000 children. At Wallsend the committee are relieving 171 destitute families, and are serving 280 children's dinners a day. At Walker and Hebburn a similar amount of work is being done.

STRENGTHENING THE ABUTMENT OF A GREAT BRIDGE.

Across the Schuylkill River at Chestnut Street, Philadelphia, is a two span bridge, begun in 1861 and completed five years later. It has two segmental arches supported by an abutment on either bank and a central pier in the river. At each side is a masonry approach. The spans are 185 feet each, and the total length of the bridge, including approaches, is 1,528½ feet. The carriage way is 26 feet wide, and the foot ways 8 feet. The western abutment is situated upon what was the river flat, there being, at the time of construction, 27 feet of mud, under which was a stratum of about 5 feet of gravel and bowlders, below which was bed rock. White oak piles were driven to a firm bed, and the heads of these, after leveling, were embedded in beton to a depth of 2½ feet; upon this foundation of piles and beton was laid a platform on which the masonry was erected.

Since completion this foundation has maintained its vertical position, but the thrust from the long flat arch, exerting a pressure of some 2,000 tons, in a few years forced the western abutment through the yielding material in which it rested. A certain amount of this thrust was communicated to the approach through the two small arches, the effect of which was to compress the joints until, with the accompanying bulging of the masonry at points, the limit of movement was reached in the approach masonry, after which it continued in a rise of the two arches. It became evident that unless this movement was arrested the span would fall into the river. The fact that the space beneath the arches was used for traffic which could not be interrupted for any length of time led to the placing of wooden struts, at water line, from the abutment to the arch pier and from the pier to the base of approach, the effect of this being to transfer the thrust, through the struts, to the solid approach. This served the purpose so well that the wonder now is that the bases were not so constructed of solid masonry at first. The struts are shown in the large view in the accompanying engraving, and were each composed of four 12 by 12 inch timbers bolted and tied to one another. By this time the abutment had moved 8 inches and the central pier had moved half that distance.

The city now sought for something more permanent to save the bridge than timber struts. Several plans were received, but those proposed by Messrs. Anderson & Barr, of Room 12, Tribune Building, New York city, were adopted. The reasons governing this decision were that they were the only plans which would not interrupt travel on the railroad using one of the arches, thereby saving the city, in damages, about $40,000; the risk of lessening the stability of the abutment during the operation would be avoided, since the space made by the removal of material would be immediately refilled with the cylinder and concrete filling; and that by these plans the work would be so completed as to need no further attention in the future.

In brief, this plan was to build four iron cylinders of one-half inch iron, 8 feet in diameter, stepped into the base of the abutment and extended downward to bed rock at such an angle (about 45 degrees) as to embrace the line of thrust of the arch, and fill them with concrete. By this plan the weight of the arch is transferred to a solid foundation through four stone columns 8 feet in diameter. In carrying out this method no further disturbance of the ground was necessary than to start the cylinder. The concrete was made of 1 cement, 2 sharp sand, and 4 broken stone. Two of these stone struts have now been completed—one 65 feet long and the other 62 feet. Work was begun Oct. 21, 1884, and the first was finished Nov. 26 and the second Dec. 16.

The plan of projecting this class of work, below tide water, is by the aid of compressed air, similar in every respect to the plan so successfully used in the Hudson River Tunnel, and which we have frequently described and fully illustrated. At the upper end of the cylinder is a vertical stem 4 feet in diameter, across the top of which extends an air lock 5 feet in width and 14 feet long. This lock is divided into three compartments by four doors. The advantage of this construction is that while one compartment is being filled with material from the outside, the other is open to the interior; all waiting is done away with, and both the passage of supplies to the lower end of the cylinder and the removal of excavated material are greatly facilitated.

In building the cylinder, a space large enough to admit an iron plate is dug out, when the plate is inserted and bolted to those already in position; adjoining spaces are then excavated and other plates put in, and in this way the cylinder is formed—plate by plate, and ring by ring, until bed rock is reached. When completed, it is cleaned out and the concrete laid.

The plant for carrying on the work consists of a double air compresser—which may be quickly converted into a hoisting engine when necessary—a twenty-five light dynamo for illuminating the interior engines, etc.

With regard to the cost of work of this nature, we are assured by the contractors that similar cylinders can be sunk to any depth up to 500 feet for less than one hundred dollars per foot.

For engineering data connected with the bridge we are indebted to Chief Engineer S. L. Smedley, and First Assistant Engineer J. M. Titlow, of the Philadelphia City Engineering Department.

Manufacture of Porcelain at the Royal Works, Dresden.

These works are at Meissen, near Dresden. The china for ornamental pressing is not used in a clay state, but as a liquid, slip-like, thick cream. This is poured into the orifice of the mould left for the purpose, and then allowed to stand for a short time; when sufficient slip has adhered to the mould, the remainder is poured back into the casting jug. The slip having remained in the mould for some minutes becomes sufficiently solid to enable the workman to handle it. He next proceeds to arrange all the pieces on a slab of plaster before him. He then trims the superfluous clay from each, and applies some liquid slip to the parts, and so makes a perfect joint, each part being fitted to its proper place, until the whole figure is built up as it was before it was moulded; as each joint is made, the superfluous slip is removed with a camel's hair pencil.

The object is next propped with various strips of clay having exactly the same shrinkage and is then ready for the oven. The shrinkage or contraction to which we have alluded is one of the most important changes, as well as one of the greatest difficulties encountered in the art of pottery. The change will be more or less, according to the materials used and the process employed in making. Thus earthenware will not contract so much as porcelain, and a pressed piece will not contract so much as a cast one. The contractions are sufficiently well known to the modeler, and he makes allowance in the model accordingly, the design being fashioned so much larger than is actually required; the shrinkage from the original model to the finished object being sometimes equal to 25 per cent.

The ware up to this point in all the stages of manufacture we have described is most tender, and can only be handled with the greatest care.

The manufactured objects being now ready for baking, are taken to the placing house of the biscuit oven, where may be seen some hundreds of seggars of all shapes and sizes. These seggars, which are made of fire clay and are very strong, are the cases in which the ware is to be burned. Common brown wares, when the fire is comparatively easy, may be burned without any protection, as the fire or smoke cannot injure them; but for porcelain or white earthenware these cases are necessary. The seggars are made of various shapes to suit the different wares. Flat round ones are used for plates, each china plate requiring its own seggar and its own bed in it, made of ground flint very carefully prepared, for the china plate will take the exact form made in the bed of flint. Cups and bowls are placed, a number of them together, in oval seggars, ranged on china rings to keep them straight. These rings must be properly covered with flint to prevent them adhering to the ware burned upon them.

The seggars when full are piled one over the other most carefully in the oven, so as to allow the pressure to be equalized as much as possible; this is absolutely necessary, as when the oven is heated to a white heat (calculated as equal to about 25,000° Fah.) the least irregularity of bearing might cause a pile to topple on one side, and possibly affect the firing of the whole oven, causing a great amount of loss. Calcined flint is used for the purpose of making beds for the ware, because being pure silica it has no melting properties, and will not adhere to the china.

The form of oven seems to have been much the same in all ages, viz., that of a cone or a large beehive. A china oven is generally about 14 feet in diameter inside. It is built of firebricks, and is incased several times round with bands of iron to prevent too great expansion from the heat inside. There are generally eight fireplaces around the oven, with flues which lead directly into the oven in different directions. A china oven takes about forty hours to fire; it is then left to cool for about forty-eight hours. In order to test the burning, the fireman draws small test cups through holes in different parts of the oven made for the purpose. These tests show, both by contraction and the various degrees of translucency, the progress of the fire. The test holes are carefully stopped with bricks, so that cold air cannot be drawn into the oven.

The porcelain having been burnt is now in the state called biscuit; it is translucent and perfectly vitreous. Having had the flint rubbed off the surface and been carefully examined, it is sent into the dipping room.

The dipping room is supplied with large tubs of various glazes, suitable to the different kinds of ware. The glaze is really a kind of glass, which is chemically prepared of borax, lead, flint, etc., that when burned will adhere to the porcelain, and will not craze or crackle on the surface. This glaze is ground very fine (being on the mill for about ten days) until it assumes the consistency of cream. The process of glazing is simple, but requires a practiced hand, so that every piece may be equally glazed and the glaze itself equally distributed over the surface.

From the dipping room the ware is brought into the drying stove, where the glaze is dried on the ware. It is then taken by women into the trimming room, where any superfluous glaze is taken off, and defective places are made good. From this room it is taken to the glost oven placing house, where the greatest care and cleanliness are required, as should any dust or foreign substance get on the glaze it will adhere in the fire, and very likely spoil the piece.

The glost oven is of the same construction as the biscuit. It takes sixteen hours to fire, and the tests are made in the same manner as in the biscuit oven. The average heat is equal to about 11,000° Fah. In about thirty-six hours the oven will be sufficiently cool for the ware to be removed. It is then sent into the white warehouse, where it is sorted and given out to the painters and gilders, to be decorated according to the orders on the books.

Visitors generally look forward with pleasure to the mysteries of the decorating department. It is interesting to watch the painters, some on landscapes, others on birds or flowers or butterflies. All are interested in their work, which to the uninitiated may appear at first sight to be very unpromising, the colors being dull, and the drawing unfinished. As the work advances, it will be better understood. After the first "wash in" has been burned, and the painter has worked upon it for the second fire, the forms and finish, both in style and color, begin to appear.

The colors used are all made from metallic oxides; thus copper gives green and black; cobalt, blue; gold, purple; iron, red, etc.

The painters are trained from about fourteen years of age under special instructors; they thus acquire a facility of drawing and general manipulation of the colors which is found almost impossible to attain at a later period of life.

The gilding process is carried on in rooms adjacent to the painting. The elaborate and finely executed patterns in gold are all traced by the hand. The workmen require special training for this department also, correct drawing and clean finish being absolutely necessary. For the purpose of getting correct circles and speedy finish on circular pieces, a simple mechanical contrivance is used. A small table or stand with a revolving head receives the plate or saucer or cup, which is carefully centered so as to run truly. The time required for enamel kiln firing is about six hours.—*Pottery Gazette.*

Balloons and Soap Bubbles.

Any photographer who may have had his stock of collodion rendered useless through the introduction of gelatine plates may find a pretty use for it during the winter season by converting it into balloons. We hasten to say not for outside use; we have no intention of endeavoring to rival our esteemed correspondent, Mr. Shadbolt—toy balloons for ascending indoors, we mean. Collodion is superior to all other substances for this purpose, and with care and a little dexterity a small quantity of collodion will furnish a good sized balloon. We have seen them from six inches to twenty-four inches in diameter.

The mode of manufacture, which is simple, is as follows: An ordinary glass flask—the shorter its neck the better—is carefully cleaned, rinsed out with distilled water, and perfectly dried. A quantity of collodion is then poured in, and the flask turned round in all directions until it is evenly coated, when the residue can be poured out, taking care to have the inside of the neck also covered with the collodion. The flask is then placed neck downward in a warm place till thoroughly dry; it will be well to give it two full days so as to insure the absence of all moisture. All that remains is to withdraw this coating of collodion without breaking it—a rather delicate operation, but one that can be performed by not being over-hasty, and carefully humoring the film. When it is quite withdrawn it can be easily filled with gas from a gas bracket, and will then, from the lightness of the material, ascend in any room. The larger sizes are made in glass carboys, and form very effective objects.

Those of our readers who do not care to go to this trouble, and yet would like to have some means of an unusual kind for amusing their juvenile sitters, should make a solution for soap bubbles, which can be inflated by hydrogen if preferred. With a properly made solution it is quite easy to produce bubbles close upon a foot in diameter, which can without bursting be rolled along the floor, played with like a shuttlecock—using the arm as a bat; or they can be placed upon a table to be admired, and many a happy, natural pose obtained when every other means have been employed. A solution of oleic acid is better than soap with glycerine and water.—*British Journal of Photography.*

THIRTY years ago an elm on the farm of P. Mariner, of Penn Yan, blew down, and the trunk, which remained in the soft ground and ran along fifty-eight feet, began to sprout. Now twenty-six trees, well grown, perfect, and some of them fifty feet high, are the result. They are not branches, but have roots, and are independent of the original trunk.

The Uruapan Ware.

Among the Mexican exhibits at New Orleans are specimens of the above ware, which are greatly admired. An interesting article from the pen of Mr. J. M. Franco, of Uruapan, is given in the *Mexican Financier*.

The articles which he describes comprise the wooden bowls, or *jicaras*, trays, center tables, and other objects made by the natives of that town, with no other instruction than that which has been handed down from their ancestors, as it has long been an industry peculiar to that locality. The wood used must be perfectly dry and of a porous nature so as to receive the first coat of sizing. The wood of the linden tree possesses good qualities, and is employed to a great extent. The sizing, which is applied first to the surface of the wood, is prepared by adding a fine powder of what the Indians call *tepushuta* to some drying oil, as *chia*, nut, or linseed, mixed with *axe*. It is spread over the wood and then rubbed in with the hand, an operation which requires considerable practice in order to obtain an even distribution and a thorough absorption into the wood. It is then ready for the reception of the different colors.

These colors are made, as a general thing, from the crude materials by the Indians, although a few are bought already manufactured. Burnt gypsum, white lead, and *ihuetacua*, reduced to a fine powder, are used in their preparation, and some of the colors are as follows, all of which are also pulverized except vermilion: Black earth, native ocher, Prussian blue, red lead, vermilion, commercial ocher, chrome yellow, and carmine. These colors are combined to form others as necessity or the taste of the painter requires, and all, excepting the black, may be mixed with white. With the vermilion and red lead, *ihuetacua* alone is mixed; with blue and orange, gypsum; and with all others, white lead. In the two latter cases a little of the *ihuetacua* is added, to insure a quick drying and a good polish. Vermilion cannot be applied directly upon the sizing, as it would soon discolor, therefore it is necessary to put on a ground of red lead before adding the vermilion.

After the sizing has been put on, the color forming the groundwork is applied with a wad of cloth and rubbed in softly. As the color becomes incorporated in the sizing and at the same time is polished, powder is added until the coloring is perfectly uniform, except when the intention is to produce a mottled appearance, which gives a good effect, especially when the groundwork is dark blue. In order to save time it is customary to paint the ground color on several pieces at once, before proceeding to detail. When the primary color is dry, an outline of the drawing is made with a sharp point, commencing with the next principal color, which serves as a ground in its turn. For example, if a bunch of flowers is to be painted, the outline of the leaves is drawn, and inside of this outline the painter scrapes off everything which has been put on, down to the wood, applies a new coat of sizing and the green coloring matter, using the cloth and rubbing the color in with the same care and deliberation. This color then serves as a ground for drawing the structure of the leaves, and the same operation is carried out with the all the different colored flowers, each color being applied directly to fresh sizing on the wood, so that no color is added to another, thereby insuring permanence, so that the articles can be washed without fear of destroying the colors. It gives some idea of the care and the length of time bestowed on these works of art when it is considered that each color must dry thoroughly, although it takes two or three days, before a new one is applied, and each shadow, high light, or new combination of color requires a distinct operation. The only way of economizing time is to have a number of articles in the same stage of painting, so that while one is drying the same color may be applied to the next one.

After the pigments are rubbed in, they are polished with the palm of the hand, and the Indian women are also very expert in polishing them with the forearm when the form of the article permits.

Liquid Hydrocarbons as Fuel.

In the course of a recent address at the Society of Arts, Sir Frederick Abel, when dealing with the various industrial applications of science which have taken place in recent years, referred to the use of certain liquid hydrocarbons as fuel for engine purposes. His remarks on this subject were as follows:

It is many years since attention was first directed to the advantages indicated by theory, and which appeared practically realizable, from the application of certain liquid hydrocarbons as fuel for engine purposes; and before even chemists dreamt of the possible future value of coal tar as a source of brilliant dyes, attempts were made to apply crude coal tar naphtha as fuel for boilers. Later on crude petroleum, and the heavier and less readily inflammable liquid hydrocarbons remaining after extraction, from coal tar and petroleum, of the portions available for color-producing and illuminating purposes, have been applied experimentally in this direction from time to time, and with some success; the liquid being injected into the fireplace in the form of a spray, by means of ordinary or superheated steam. A successful experiment has quite recently been made at the Forth Bridge works, in working the furnace of one of the air-compressing engines with the residual product of the distillation of shale oil, obtained at one of the largest Scotch mineral oil works.

This butter-like material, liquefiable by heat, for which no use has been found, even for coarse lubricating purposes, and which cannot be ignited by the application of flame in the ordinary way, is allowed to flow through a superheating apparatus, and is thence carried into the furnace by a powerful jet of superheated steam. The force of the jet draws a powerful current of air into the center of the flame produced by burning the mixture of vapors and of minutely divided liquid; and the result is said to be an almost perfect combustion of the fuel, with total absence of smoke and of solid residue in the furnace. Even at the locality of this experiment, where coal is cheap, it is claimed that an ultimate economy will be effected by the use of this fuel; the cost of labor for stoking being much diminished. This experiment has been valuable as showing that the residual products of British mineral oil works may be utilized with advantage as substitutes for coal. But far more important results have been obtained in this direction in Southern Russia during the last few years. The value of the residual product of petroleum distillation, as an efficient and economical source of steam power, has been conclusively established in connection with the marvelous development, by the Brothers Nobel, of the petroleum industry at the Baku works, which are fed through pipe lines of an aggregate length of upward of 60 miles, by the apparently inexhaustible supplies of petroleum of the Aspheron Peninsula.

The residual or heavy oil, which remains after extraction of the illuminating and the lubricating oils from the petroleum, and of which Messrs. Nobel alone now produce 450,000 tons annually, is already used as fuel on upward of 300 steamers upon the Caspian Sea and the Volga, and by the locomotives on the Trans-Caucasian and Trans-Caspian railways. Its use is also extending to other railways in Southeast Russia and to manufactories in Moscow, where it is rapidly replacing English coal. In an instructive paper on the employment of refuse petroleum as fuel in locomotive engines, recently communicated to the Institution of Mechanical Engineers, Mr. Urquhart has shown that, weight for weight, it has 33 per cent higher evaporative value than anthracite, and that while 60 per cent of efficiency is realized with the latter, 75 per cent is obtained with petroleum refuse. The very rapidly continuous extension of the Russian petroleum industry appears to assure a most important future to liquid fuel; and though it is hardly likely to compete in this country with coal for locomotive purposes generally, the comparative ease with which its perfect combustion is now insured appears to render it especially suitable for employment in underground railways; while its use in steamers cannot fail to be attended with important advantage in many special services.

Plumbing at the Time of Edward III.

The following is a full text of a remarkable ordinance existing more than 500 years ago relating to plumbers. The *Sanitary News* has unearthed the document, which we copy *verbatim*.

38 *Edward 3d*, A.D. 1365. *Letter Book E.* (*Norman French.*)

May it please the honorable men and wise, the Mayor, Recorder, and Aldermen of the City of London, to grant unto the Plumbers of the said City the points that here follow:

In the first place that no one of the trade of Plumbers shall meddle with the works touching such trade within the said City, or take house or apprentice, or other workmen, in the same, if he be not free of the City; and that, by assent of the best and most skilled men in the said trade, testifying that he knows how well and lawfully to work, and to do his work; that so the trade may not be scandalized, or the commonalty damaged and deceived, by folks who do not know their trade.

Also, that no one of the said Trade shall take an apprentice for less than seven years; and that he shall have him enrolled within the first year and at the end of his term shall make him take up his freedom, according to the usage of the said City.

Also, that every one of the Trade shall do his work well and lawfully, and shall use lawful weights, as well in selling as in buying, without any deceit or evil intent against any one; and that for working a clove of lead for gutters, or for roofs of houses, he shall only take one-half penny; and for working a clove for furnaces, *tappetroghes*, belfries, and conduit pipes, one penny; and for the waste of a wey of lead when newly molten [he shall have an allowance of two cloves], as has been the usage heretofore.

Also, that no one for singular profit shall engross lead coming to the said City for sale, to the damage of the commonalty; but that all persons of the said Trade, as well poor or rich, who may wish, shall be partners therein at their desire. And that no one, himself or by another, shall buy old lead that is on sale, or shall be, within the said City or without, to sell it again to the folks of the said trade, and enhance the price of lead, to the damage of all the commonalty.

Also, that no one of the said Trade shall buy stripped lead of the assistants to tilers, *laggers*, or masons, or of women who cannot find warranty for the same. And if any shall do so, himself or by his servants, or if any one be found stealing lead, tin, or nails, in the place where he works, he shall be ousted from the said Trade forever, at the will and ordinance of the good folks of such Trade.

Also, that no one of the said Trade shall oust another from his work undertaken or begun, or shall take away his customers or his employers to his damage, by enticement through carpenters, masons, tilers, or other persons, as he would answer for damage so inflicted, by good consideration of the masters of the Trade.

And if any one shall be found guilty under any one of the Articles aforesaid, let him pay to the Chamber of the Guildhall, in London, for the first offense 40 pence; for the second half a mark; for [the third 20 shillings; and for the fourth, 10 pounds, or else forswear the Trade.

The Fire Waste of the Country.

Mr. C. J. Hexamer has been delivering a series of lectures before the Franklin Institute, of Philadelphia, on the fire waste of the country.

His lectures have received considerable attention, and the *Fireman's Journal*, of this city, from whose columns the following is extracted, considers Mr. Hexamer's lectures full of practical suggestions. His lecture last week was on "Fires in Textile Mills," the special feature of it being on the construction of such mills with a view to fire prevention. The lecturer said that one of the most important precautions to be observed in erecting mills was to insure the confining of a fire to the apartment in which it originates. All stairways and elevators should be built in a shaft beside the building proper, the openings between them being shut off at the different floors by iron doors. The next precaution to be observed is in the construction of the floors. The best form of fireproof floor is of brick arches built between iron girders placed at short distances. Floors of concrete or "terra cotta lumber," a porous clay material that can be readily cut and shaped with edge tools, rank next in security. If ceilings are of wood, they may be covered with fine wire netting and plastered over, or they may be rendered practically "fireproof" by coating with asbestos paint or by liberal and frequent applications of common lime whitewash. Additional loss is frequently caused by having floor beams so deeply embedded in the side walls that when they burn through in the middle the weight upon them causes the overthrow of the walls when the floors fall in. This can be easily avoided by placing the joists so that they fall out when burned through in the middle. Fire doors are best made of heavy wood, covered on both sides with sheet iron and fastened to the brick wall. Two fruitful causes of fires in mills are the lighting and heating arrangements. Hot water pipes are the safest, steam pipes ranking next. To avoid having combustibles placed in contact with them, they should be suspended from the ceiling, where they are out of the way and give the best heating results. The incandescent electric light is the safest, though there are many risks when improperly introduced. Mr. Hexamer explained how such risks might be avoided.

The International Inventions Exhibition, London.

The applications for space have now all been examined by sub-committees of the Council, and a selection has been made of the most promising. The number of applications has been so great that it has been decided to limit very strictly the admissions in those classes which may be considered to have been fully represented in the exhibitions of the present and of the past year. The Council will, therefore, be obliged to refuse many valuable exhibits in such classes as those relating to food, clothing, and building construction. It will even be a difficult matter to accommodate those which have been selected, and it is feared that the list will have to be still further reduced. As soon as possible, information will be sent to those who have applied for space; but the enormous number of applications, far in excess of what was expected, has made it impossible to do this up to the present. The guarantee fund now amounts to £48,280, a sum considerably in excess of that subscribed for the Health Exhibition or for the Fisheries, the amount for the former being £26,518, and that for the latter, £26,656.—*Journal of the Society of Arts.*

THE *Buletin Commercial*, of Havana, gives an account of a perpetual motor invented in Barcelona, said to consist of a wheel with arms, which is furnished with weights, the power being developed by the movement of the weights from the extremities of the arms toward the center. The power of the motor, it is alleged, may vary from eight pounds up to thousands of H. P. We are sorry to be obliged to say that this is a very old form of perpetual motor, which up to the present time has stood still.

Electric Lighting in London.

At a recent meeting of the Society of Arts, London, Mr. W. H. Preece gave an interesting account of his observations in this country concerning the use of the electric light, after which the chairman, Sir Frederick Bramwall, spoke of the great obstacle to the progress of electric lighting in England, viz., that owing to the wires having to be put under the streets, the belief being entertained (though that was a moot point) that the local authorities had no power to grant permission for this, and that Parliament had to be applied to. Mr. Hammond had spoken as if the only objection to this was the delay and expense in obtaining the act, and why he and every other speaker had refrained from touching on what was the real obstacle he did not know; but it was a pity to close the discussion without reminding the meeting of what it was that really prevented electric lighting from central stations being carried out in England. It was not simply that an act of Parliament had to be obtained, but that when obtained it would be unfair, because it would have to be in accordance with a general act which must have been passed with the express intention of forbidding the progress of electric lighting.

Imagine a new steamboat company being started in Liverpool, which would have to use the docks, and assume that these docks belonged to the corporation, and that to be allowed to use them it was necessary to obtain an act of Parliament, and that the condition of its being allowed to use the docks was that at the end of twenty years, if the company paid a dividend, the corporation should be entitled to purchase the undertaking for the value of the old materials; but if the company did not pay, the corporation should not be obliged to purchase. He said that this appeared to his hearers to be ridiculous; but why was it more ridiculous in connection with a steamboat company than in connection with the distribution of electricity?

It was a mere accident that they had to go to Parliament; it was because they required to lay the wires under the streets in the same way as gas companies required to lay gas pipes. When the Electric Lighting Act was in the House of Commons, the Board of Trade tried to say that at the end of fifteen years the local authority in whose district the wires were laid should have the option of purchasing the undertaking, not for what it had cost, but on the then value of the material for their purpose. All apparatus put down in process of developing, which had been removed to make way for better, would not be reckoned as one shilling in the valuation.

When the bill got into the House of Lords, an effort was made to improve it, but the utmost concession obtained was to increase the fifteen years to twenty-one; and thus it stands that, at the end of that time the company, if the venture paid, must submit to be bought out at the value of the old materials. If it did not pay, no one would care to take it; but the company might go on until they had worked the affair up to a profit, not for their own benefit, but for that of the local authority, for after the first option of purchase, at the end of every five years in perpetuity the option rearose, and might be exercised to purchase the property for the value of the old materials.

Subterranean Woods.

Clarence Deming, in his "By-ways of Nature and Life," says of the swampy region of southern New Jersey:

"The huge trees which lie under the swamp to unknown depths are of the white cedar variety, an evergreen, known scientifically as the Cupresses Thyoides. They grew years ago in the fresh water, which is necessary for their sustenance, and when in time, either by a subsidence of the land or a rise of the seas, the salt water reached them, they died in numbers. But many of them ere they died fell over as living trees, and were covered slowly by the deposits of muck and peat which fill the swamp. Those trees that fell over by the roots, and known as 'windfalls,' to distinguish them from the 'breakdowns,' are the ones most sought for commercial uses, and they are found and worked as follows: The log digger enters the swamp with a sharpened iron rod. He probes in the soft soil until he strikes a tree, probably two or three feet below the surface. In a few minutes he finds the length of the trunk, how much still remains firm wood, and at what place the first knots, which will stop the straight 'split' necessary for shingles, begin. Still using his prod, like the divining rod of a magician, he manages to secure a chip, and by the smell knows whether the tree is a windfall or breakdown. Then he inserts in the mud a saw like that used by ice cutters, and saws through the roots and muck until the log is reached. The top and roots are thus sawed off, a ditch dug over the tree, the trunk loosened, and soon the great stick, sometimes five or six feet thick, rises and floats on the water, which quickly fills the ditch almost to the surface.

The log is now sawed into lengths two feet long, which are split by hand and worked into shingles, as well as into staves used for pails and tubs. The wood has a coarse grain which splits as straight as an arrow. The shingles made from it last sixty or seventy years, are eagerly sought by builders in southern New Jersey, and command in the market a much higher price than ordinary shingles made of pine or chestnut, which last for roofing usually not more than twenty or twenty-five years. In color the wood of the white cedar is a delicate pink, and it has a strong flavor, resembling that of the red cedar used in making lead pencils. The trees, once fairly buried in the swamp, never become waterlogged, as is shown by their floating in the ditches as soon as they are pried up, and what is more singular, as soon as they rise they turn invariably with their under sides uppermost. These two facts are mysteries which science has thus far left so. The men who dig the logs up and split them earn their money. The work, according to the *Industrial World*, is hard, requiring, besides lusty manual labor, skill and experience; the swamps are soft and treacherous, no machinery can be used, and long stretches with mud and water must be covered with boughs or bark before the shingles can reach the village and civilization.

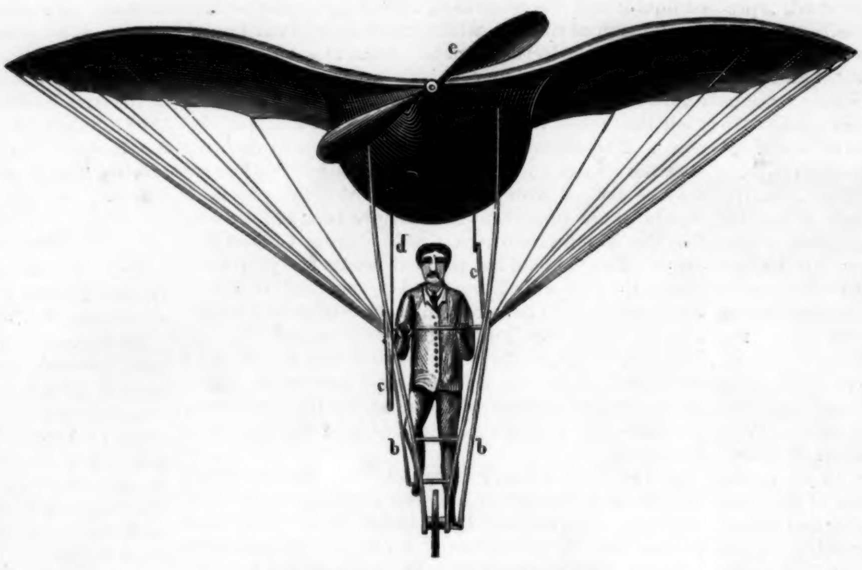
GOUPIL'S AEROPLANE.

The accompanying figures give end and side views of an aeroplane devised by Mr. A. Goupil, and described by him in a recent work upon aerial navigation. The apparatus might be termed a sort of aerial velocipede. The man, in order to obtain speed, acts at one and the same time, though the pedals, *a a*, and the connecting rods, *b b*, upon a wheel that moves over the ground, and through jointed arms, *c c*, upon the helix, *e*; and he likewise acts upon the rudder, *f*, and the tail lever, by means of cords. In measure, as the apparatus obtains velocity its weight diminishes on account of the increase of the vertical reaction of the current, and, finally, it ought to ascend and maintain itself aloft solely through the motion of the helix combined with the sustaining action of the wings and regulating and directing action of the rudder. Equilibrium must be maintained through the displacement of the man's center of gravity.

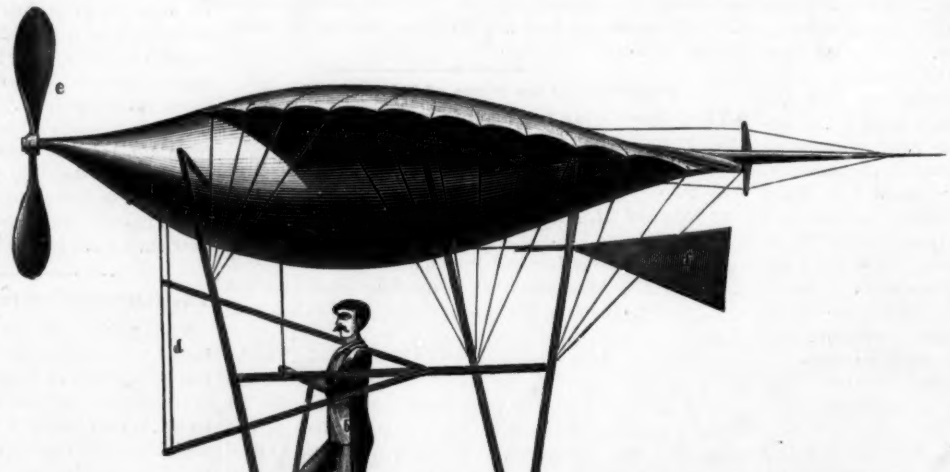
The construction of the apparatus (which is of thin strips of wood cross-braced by tough wood and covered with silk) is of the lightest character. The whole weighs 220 pounds.

Certain persons will smile, perhaps, upon first glancing at the figures of this new aerial velocipede; and others, upon reading the conditions of the apparatus' working and the hopes that are had of it, will be tempted to ask us if such apparatus have already operated—a question which we cannot answer affirmatively. However, if it is allowable to smile innocently at such claims, it is perhaps less allowable to have doubts. The rules of mechanics do not contradict the assertion that it will one day be possible for man to rise and direct himself in the air when the latter is undisturbed by storms.

When aluminum and still lighter and more powerful motors shall intervene, the solution of the problem will not have to be long awaited. But what will prove more difficult yet, after this very solution, will be the practice of the thing. It is not everything to have a sure and well rigged ship that fulfills all the conditions of good navigation, for a crew is likewise necessary. When, then (however distant the period), it shall be felt that the end has been about reached, it will be necessary to instruct the future fliers to preserve that coolness and precision of motion in the air that should contribute to secure the necessary conditions of precise maneuvering and perfect equilibrium.—*Chronique Industrielle.*



GOUPIL'S FLYING MACHINE.



GOUPIL'S FLYING MACHINE.

Mechanical Toys.

The recent holiday season is said to have afforded a particularly active business in mechanical toys. A dealer says: "The run on them has been something wonderful. The baby doll that walks and squeaks, says mamma and papa at each mechanical theatrical stride, sold like hot cakes. They have simply been improved upon very much, but not recently invented. The mechanical smoking man is a late patent. It is a comical figure of a man eleven inches high, seated on a black walnut box and a small keg at his elbow, with the historical long pipe and mug of beer in his hand. Place a cigarette in his pipe, and, when wound up and the cigarette lighted, the figure will draw and puff the smoke in a perfectly natural manner. The motions of the head and arm and the action while smoking are perfect. These have sold rapidly to the small boys, ambitious to learn how to smoke and use tobacco.

"But one of our latest hits is the stump orator. It is a negro with a carpet bag in one hand and an umbrella in the other. He makes motions, pounds the desk in front of him with the umbrella, and assumes positions of appeal, entreaty, fierceness, and humor such as the orators of the day do when speaking. The dog cart with the dude in it driving a prancing horse is put in the show window for the first time this season.

By winding it up, away it goes until it runs down. The bear that walks about snapping his jaws cost a lot of time and money to perfect."

A ONE THOUSAND FOOT TOWER.

In January, 1874, the SCIENTIFIC AMERICAN gave the drawings and details of a one thousand foot tower which was proposed to be constructed by Clarke, Reeves & Co., in Fairmount Park, Philadelphia, Pa., near the Centennial Exhibition grounds. This idea was not carried out, but it has just been taken up again in France.

The example of the largest buildings that have been constructed up to the present shows that it is difficult, with materials in which stone plays the chief role, to exceed a height of from 490 to 525 feet, which may be considered as a limit rarely reached. In fact, the principal heights of known buildings are as follows:

	Feet.
Washington Monument	555
Cologne Cathedral	520
Rouen Cathedral	490
Great Pyramid of Egypt	478
Cathedral of Strassburg	465
Cathedral of Vienna	452
Saint Peter's of Rome	433
Capitol, Washington	288
Spire of the Invalides	344

In order to exceed these heights it is necessary to have recourse to the use of metal, which is the only material that permits not only of supporting the vertical reactions of the structure, but also of resisting the stresses of flexion resulting from the action of the wind, and which is considerable for great heights.

It is such an application that has permitted the authors of the project of which we are speaking to propose a monumental tower that they have no fear of carrying up to a height of 300 meters (984 feet), and which will thus be nearly double that of the highest monuments known. This height of 300 meters might again, if need be, be notably exceeded.

The tower is designed, in the mind of its projectors, to form part of the structures that will be erected on the occasion of the Universal Exhibition of 1889.

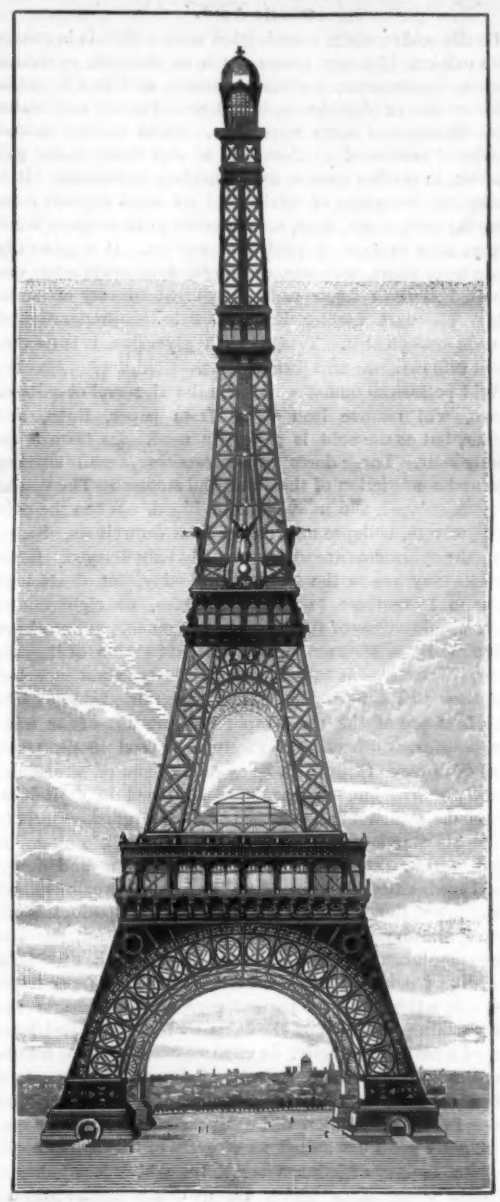
The metallic columns that have been constructed in recent times have usually reached a height of about 195 feet, and, in the present state of engineering art, there are no very serious difficulties in the way of reaching 260, and even 325 feet; but the question is entirely otherwise with the projected height of 984 feet, and in the detailed study there occur difficulties analogous to those that would be met with in the study of a bridge were it desired to pass from a span of 490 to one of 984 feet.

In fact, to cite but one special point, if we do not wish to multiply the uprights of the framework, we are forced to put in diagonal stays which exceed practical limits, and which at the base of the column reach lengths of more than 325 feet.

If, on the contrary, we multiply the uprights, we get a structure which is extremely heavy and of a deplorable architectural effect. It was necessary, therefore, to find a mode of construction which should limit the number of uprights, and nevertheless permit of doing away with the diagonal stays. This has been achieved in the present project, presented by Mr. G. Eiffel, the builder of the Garabit Viaduct. The framework of the tower consists essentially of four uprights that form the corners of a pyramid whose faces form a curved surface. The curve of such surface is determined by certain theoretical considerations of resistance to the wind that are characteristic innovations of the project, and to which we shall have occasion to revert when the latter is definitely established.

Each of these uprights has a square section that diminishes from the base to the summit, and forms a curved latticework 49 feet square at the base and 16 at the top. The bases of these upright are spaced 328 feet apart. They unite at the apex and form a platform 33 feet square. These uprights are anchored to a solid masonry foundation, and are connected at different heights by horizontal platforms that serve as a support for vast halls which will be utilized for the different services that will be installed in the tower. The one on the first story, the flooring of which will be 230 feet from the ground, presents a superficies of about 5,400 square feet.

At the lower part, and in each of the faces, is a large arch of 230 feet opening, forming the principal element of the decoration. It gives the tower that monumental aspect which is indispensable for the purposes for which it is intended. At the apex there is a glass cupola from whence a vast panorama may be seen by the spectator. This part will be reached by elevators in the interior of the uprights, so arranged as to give absolute security. Aside from the attraction and monumental aspect that will be presented by this tower, the boldest manifestation of engineering art of our epoch, it will be susceptible of different uses that will be taught by experience, and, among which, we can already foresee the following:



A ONE THOUSAND FOOT TOWER.

1. *Strategic Observations.*—In case of war there may be seen from the tower all the movements of the enemy within a radius of ten miles.

2. *Communications by Optical Telegraphy.*—In case of an investment, or of suppression of the ordinary telegraph lines, it will be possible from this elevated post to communicate by optical telegraphy with places at a considerable distance, such as from Paris to Rouen, for example, where the second observer will be placed upon a high hill.

3. *Meteorological Observations.*—An observatory at 984 feet above ground does not as yet exist, and a large number of questions, notably the direction and violence of atmospheric currents at such a height, has not yet been solved.

4. *Astronomical Observations.*—At this great height, the purity of the air, and the absence of the fogs that often cover the horizon of Paris, will permit of a certain number of observations that are now nearly impossible in ordinary weather in this city.

5. *Electric Lighting at a Great Height.*—By arranging electric lights of sufficient power upon this tower, as has been done in certain American cities, it will be possible to obtain a general illumination whose advantages have long been recognized, but which has not yet been realized on a vast scale. In this way the entire exhibition and its approaches may be lighted in the completest and most agreeable manner, by means of a single luminous center.

Still other applications may be foreseen, either in the domain of practice, such as the indication of time to a great distance, or in the domain of science, which will for the first time have at its disposal a height of 984 feet that will permit of studying the fall of bodies, the resistance of air at different velocities, certain laws of elasticity, the compression of gases or vapors, the planes of oscillation of the pendulum, etc., etc.—*Les Annales des Travaux Publics.*

MACHINE FOR MAKING COMPRESSED YEAST.

The engraving which we present herewith is sufficiently clear to enable the apparatus to be readily understood. After the device is properly mounted, a force pump is connected with the chamber in which the yeast has been placed.

The filters consist of fabrics which are stretched in frames, these being held firmly pressed against one another, so that the yeast may not escape between the points of contact of the frames.

In order to put the apparatus in working order, the wheel screw is turned until the filtering plates press firmly against one another. The machine is charged by means of the force pump which is connected with it. At first it is necessary to pump quite slowly, until the liquid passes through all the chambers of the filter, and then the pump is worked more rapidly until it becomes quite difficult to move it.

As soon as the water ceases to flow, except drop by drop, from the opening, which occurs ordinarily in 40 or 45 minutes, and as soon as the safety cock connected with the receiving pipe permits the yeast to escape (being driven back by the pump), then is it time to empty the chambers. In order to accomplish this, the wheel is turned and the movable head of the first filter chamber is removed, which leaves the yeast quite exposed; the yeast is scraped with a knife from the straining cloth into a receiver placed under the press. In the same manner each chamber is emptied in succession.

This being accomplished in order to put the press in a proper condition for future use, care must be taken to remove all the yeast that may cling to the frames and the straining cloths. If this precaution is not taken, the yeast will probably escape from the chambers during the next operation.

The improved yeast presses of Messrs. Wegelin and Hubner are constructed on four models. The largest, which are provided with 18 chambers, will produce from 3,000 to 3,500 pounds of compressed yeast in 12 hours, ready to export. As they only measure about 6 by 3 feet, the room they occupy is very small as compared with the work they accomplish.

One man is sufficient to operate the press. The liquid yeast is reduced without the slightest loss to the desired consistency, and the water which is squeezed out of the yeast is quite pure, while the preparation of the yeast is accomplished with great cleanliness. The filtering cloths used in these presses are placed in the closed chambers on frames having fine perforations.

This is a much more satisfactory process than the filtering pockets employed with presses provided with a simple lever or screw. These pockets under the weight of the press are distended laterally. The fabric is rapidly worn, and these pockets when filled with yeast give way, and a loss of the yeast is an inevitable consequence.

This defect is not to be apprehended with the filter press, and the saving resulting from its use would very soon pay the first cost of the machine.—*La Distillerie.*

MACHINE FOR MAKING COMPRESSED YEAST.

THE amount of counterfeit paper money now in circulation is said to be less than at any time in the last twenty years.

Correspondence.

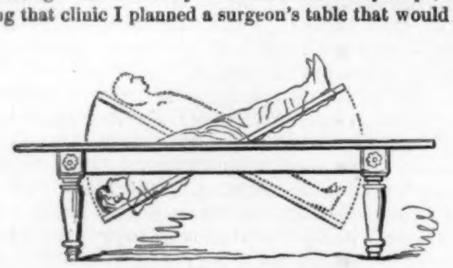
Syncope Treated by Reversing.

To the Editor of the Scientific American:

In your article of November 29, entitled "Chloroform Syncope treated by Reversing," reported by Dr. Garland in the *British Medical Journal*, he considers that the life of his patient was due to reversing the body, and that this simple treatment of a grave trouble was not used as much as it should be; that he only remembered seeing one report of its use. I am confident that it is not generally known and used, since about three years ago an article was published, and I think in your columns, stating that a French surgeon had discovered that mice chloroformed to complete insensibility were instantly restored by reversing, that is, holding them up by their tails. This was very generally received and reported as a new discovery in science.

It was not new, but valuable, however, as confirming the theories, opinions, and probably the practice of American surgeons.

In 1872, while attending Dr. Julian J. Chisolm's eye and ear clinic as a student at University of Maryland, I witnessed what might have been an accident from chloroform in the hands of less experienced surgeons. Dr. Chisolm has a record of giving chloroform very boldly, and with remarkable success and good fortune; had the accident proved fatal, the moral effect would have been disastrous to the class, and prevented many possible operations with this and other valuable anæsthetics. Dr. Chisolm taught "reversing" as a quick and practical remedy for fainting. My reading, studying, and limited experience suggested "reversing" as a remedy for chloroform syncope, and during that clinic I planned a surgeon's table that would instantly, by withdrawing a peg, permit the patient's head to go down and feet up, thus mechanically supplying the brain with oxygenated blood, and restoring life to the patient. I have long thought that this simple table would lessen the number of deaths, but fortunately or unfortunately, perhaps, I have never had an accident, and consequently no opportunity to test the apparatus myself and give the idea to the public for what it is worth. The same end could be reached by doctors in rural districts by having a movable support for cot, or table, or board, and without ceremony kick it away in event of accident.



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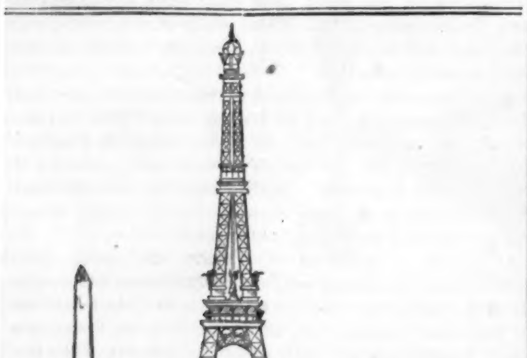

ONE THOUSAND FOOT TOWER COMPARED WITH DOME OF CAPITOL AND WASHINGTON MONUMENT.

The Metric System.

In the report on weights and measures presented to Parliament by the Board of Trade, under the Weights and Measures Act, 1878, Sir T. H. Farrer remarks, in reference to the metric system, that an opinion has been expressed by the Board of Trade that the time has now arrived when this country might with advantage join the International Convention on Metric Standards under proper conditions, provided such a course is not to be taken as an adhesion, on the part of the United Kingdom, to the metric system. These observations appear to be intended as a reply to the eighth resolution of the conference of the International Geodetical Association, held in Rome in October last, which expresses a hope that, if the rest of the world accepts the meridian of Greenwich for the unification of longitude, England will find in this agreement an additional motive for taking a new step in favor of the unification of weights and measures by adhering to the metrical convention of May 20, 1875.

Oxalic Acid.

Oxalic acid exists in combination with ammonia in guano, with calcium in many plants, such as rhubarb, curcuma, ginger, squills, orris, valerian, quassia, and as acid potassium oxalate in phytolucca, belladonna, rumex, and oxalis, most lichens, and many vegetables. Some urinary calculi consist of oxalate of calcium. It is also found in the gall bladder, in uterine mucus, and in urinary sediments. It is formed by the action of nitric acid on most organic compounds; even sugar, gum, and sawdust yield oxalates when heated with hydrate of potassa or sodium. It is generally made from sugar, molasses, or starch, with nitric acid; one hundred parts of sugar make fifty-eight to sixty of oxalic acid. The dark mother liquids left in the preparation of tartaric acid yield it. Treated with glycerine, it is decomposed into carbonic and formic acids.

Acid potassium oxalates, called salts of sorrel or salts of lemon, will remove iron stains from paper, linen, and leather, but oxalic acid is generally used. Its taste is intensely sour. Large doses cause vomiting, with burning pain and constriction of the throat and stomach. The vomits are dark colored, and may contain blood. When the pain is very severe, collapse may ensue, with drowsiness. Sometimes the symptoms are unaccountably long delayed. Some patients may live to the twenty-third day, but death may occur in from three to twenty minutes, or eight hours. Dark discolorations of the œsophagus, stomach, gelatiniform softening of the stomach, and even perforation of it, may occur. The blood is said to be universally bright in color. *Antidotes:* Chalk in water, slaked lime, dried whitewash, etc. It is one of the most rapid and unerring of the common poisons, and hence has rarely been used in the treatment of disease. Still it can be as safely handled as arsenic, aconite, or atropine. It has been suggested in an induration of the stomach and sclerosis of other organs, especially of the brain and spine, in which it causes softening. It seems to have a specific action on the lumbar and dorsal spinal cord. In one case there was great weakness and numbness of the legs and back, so that the patient could scarcely stand, much less walk. In another case, the first thing complained of was acute pain in the back, gradually extending down the thighs, occasioning ere long great torture. In a third case the patient complained more of the pain shooting down from the loins to the thighs and legs, than of a pain in the belly. In a fourth case there was numbness, tingling, and pricking in the back and thighs. In a fifth case, there was almost complete loss of power and motion in the legs, which did not pass off for fifteen days. It evidently must be suited to diseases of the spinal cord, opposite, or very different, from those which it produces. The only preparations which are used are the oxalates of cerium and iron. The former sometimes controls vomiting, due to reflex irritation from pregnancy, nervous and uterine derangements. It is very insoluble, and hence often inert, and has been given in doses of from one to eight grains three or four times a day. The oxalate of iron is also comparatively insoluble, and hence nearly inert.

Pots within Pots.

I have often felt surprised, says a correspondent of *The Garden*, that the advantages of placing one pot within another have not been recognized by plant growers. In one pot the roots must be exposed to atmospheric changes calculated to act prejudicially upon them.

In warm houses which do not get much ventilation, and which are shaded from hot sunshine, this disadvantage is not so apparent, but in the case of cool houses where air is freely admitted, and where the force of the sun is fully felt, it is evident that those roots which work their way to the side of the pot are not happily placed. Let any one place their hand on the outside of a pot nearest the sun on a fine day, and they will be ready to admit that the tender rootlets of the plant growing in it must be sorely tried. It is the same in the open air, although it is possible, if not always practicable, to plunge the pots; but it is even worse in the case of pots standing on window ledges, balconies, and similar places, as they not only often get the full sun upon some portion of their surface, but are exposed to every drying current of air.

The wonder is that plants thus circumstanced can live and thrive. Wherever plant culture is attempted on the outside of windows, some provision should be made for screening the pots from the full force of the sun. There is nothing better than a box made to fit the window ledge, and the full depth of the pots intended to be placed in it. This alone will infinitely help the plants, and if in addition some moss is stuffed in between the pots, there will be a greater resemblance to the conditions which plants enjoy when growing naturally. Where this plan cannot be adopted the pots may be put in others a size larger, so that the roots will at any rate receive double protection.

When growing delicate rooted plants in cool houses I have frequently placed one pot in another two sizes larger, ramming moss or something similar in between them. The advantage of this is that it not only guards the roots against the chilling influence of a free circulation of air, but preserves the soil in a more equable condition as regards moisture. Every one who has much to do with plant growing is aware that there is one condition of the soil which greatly favors root production, viz., between wet and dry, or what is often termed "just moist." It is a knowledge of this fact which causes us to plunge and cover over bulbs when potted, as the greatest quantity of roots is made when the soil has not to be watered, and yet does not become dry ere the growth issues from the bulb. Mainly on this account, too, are cutting and seedlings kept rather close and always screened from currents of air until the roots fairly touch the sides of the pot. At one time I used to rather largely grow the tuberous rooted Tropæolum, and never succeeded so well under pot culture as when I set one pot within another, and filled the space between them with moss. Until I adopted this method I never could manage the rather miffy, delicate rooted T. azureum.

The pot within pot system I used to find helpful in regulating the watering of such plants as this, as, if on looking through in the morning the soil was nearly but not quite ready for more water, I knew I could leave it till the next day, and there is nothing so injurious as giving a plant water now because it will in all probability need some a few hours hence. I feel sure that in the case of plants grown in small pots for decorative purposes the plan here recommended would be found to answer well; and as to the labor involved therein, it would simply be a matter of first outlay, to be quickly compensated for by a decrease in the watering. A plant with its roots in a 2½ inch pot put into a 4½ inch pot with moss rammed in between the two is more easily managed and does not require half the attention that it would have done had it been shifted.

My impression is that plants are far too often repotted; with a top dressing and double potting better plants would often be obtained, and they would be better fitted for the purpose for which they are intended. In the raising of seeds I have often practiced the pot within pot system, as, when the pots or pans are removed to a more airy situation, more water is generally required, and tender rootlets frequently get surcharged. By thoroughly moistening the moss stuffing every day or two, the soil is easily kept in just the right state of moisture down to the bottom of the pot; whereas in an ordinary way the lowermost part of the compost dries out nearly as soon as the top, and a rather heavy watering is required to moisten it through. By wetting the stuffing material and giving a light sprinkling over the surface soil, the conditions best suited to root production, and therefore to healthy growth, are easily maintained.

Preparation of Paper Pulp with Sulphurous Acid.

The inventor of this process, Mr. Raoul Pictet, never tires of multiplying the applications of sulphurous acid, a product whose properties he has already utilized under various forms in the production of cold. At the sixty-sixth session of the Helvetian Society he read a paper on the use of this acid and of a low temperature for the manufacture of paper pulp from wood, an article that in recent years has come into extensive use in the paper industry.

When ligneous substances, such as wood, straw, sedges, etc., are heated, and their temperature is progressively raised, it is found that all the multiple products contained in these bodies undergo no appreciable transformation up to a temperature of 80° C. Above such a point the gums, resins, and all the products left in the wood by the rising and descending sap tend to become brown, to blacken, and to carbonize. The cellulose, which constitutes the essential element of each fiber, is capable of resisting without alteration up to 180°. Above that temperature it becomes decomposed and destroyed.

In the manufacture of pulp for the paper industry, the object to be attained is the disengagement of the fibers of the cellulose contained in the ligneous elements from the incrusting matters by which they are on every side enveloped. Up to the present time the disintegrating of the wood has been effected by placing it in small pieces (sawed or chopped) into strong boilers, and pouring upon it, simultaneously, solutions of sulphite of lime or magnesia. The whole is then raised to a temperature of 150° or 160°, and allowed to boil for several days. All the incrusting matters are gradually dissolved, and nothing remains except cellulose; but the carbonization of the incrustation has blackened the latter, and deposited millions of atoms of carbon upon the elastic sides of the fibers. So repeated washings and a costly bleaching are rendered necessary before it is possible to sell the product obtained.

Mr. Pictet thinks that the majority of these difficulties can be suppressed by the use of a properly selected liquid which shall have the property of dissolving the incrusting matters and of furnishing, at a temperature of about 80°, the pressure of five atmospheres, which is necessary to cause the dissolving liquid to enter the pores of the wood. Concentrated solutions of sulphurous acid and water give complete satisfaction from this point of view.

In the operations that are necessary to procure such solutions, we may obtain strong pressures at temperatures embraced between 75° and 80°. These solutions totally dissolve the incrusting materials without alteration, and the latter are found integrally in the lixivium. The natural cellulose, neither altered nor blackened, is bleached with chloride of lime with the greatest facility, and, through evaporation, one removes all the by-products that can be of immediate utility.

Mr. Pictet has obtained paper of varying quality from all the textiles found in the canton of Geneva, and from wild grasses, sedges, reeds, and the most diverse kinds of woods, such as white and red spruce, beech, ash, etc. It only remains to know whether the process is adapted to a sufficiently economical exploitation to allow it to be substituted for the methods of preparation that are usually adopted.—*La Nature.*

The Blood Fluke.

In the SCIENTIFIC AMERICAN for November 8 appeared an account of a parasitic worm (*Filaria Bancrofti*) belonging to the order *Nematoda*, whose larvæ inhabit the blood of human hosts. The blood fluke (*Bilharzia hæmatobia*) belongs to a quite different order of parasites, the *Trematoda*, and the adult worms have for their habitat the portal system of blood vessels and the veins of the bladder and mesentery of man.

This terrible parasite was discovered by Bilharz in 1851. It may be described as follows: The male and female organs occur in separate individuals, which differ from each other very decidedly in form and structure. The body of the male is cylindrical, and measures one-half inch in extreme length; the tail is pointed, and the intestine is represented by two simple blind canals. From a little below the ventral sucker to the tail runs a slit-like cavity—the *gynæcophoric canal* —in which the female is lodged during the copulatory act. The body of the female is filiform, much narrower than that of the male, and attains a length of four-fifths of an inch. The intestine is unlike that of the male, the two portions being united after a short separation to form a broad spiral tube extending down the center of the body. In both sexes the oral and ventral suckers are placed near each other, and at the anterior portion of the body. In both male and female the reproductive orifice is situated just below the ventral sucker.

The eggs are oval, pointed at one pole, and measure one-seventieth of an inch in length, though they vary somewhat in size. The shells are brown in color, and transparent, and through them can be seen the ciliated embryo in an advanced stage of larval growth. The embryo is cylindro-conical in shape, and has a conical head, and, as already mentioned, is covered with cilia. It possesses the power of rapid movement in a high degree.

The ova are passively transformed to the interior of the bladder through the ulcers on its walls, which are caused by the presence of the adult parasite, and which communicate with the blood vessels, which are inhabited by the latter. In persons suffering from this form of helminthiasis the urine is loaded with ova with their contained embryos.

These being passed, it is readily seen how easy is their transmission to ponds, streams, or rivers, especially as there is generally surface drainage only in the countries where this fluke is found. Once having reached fresh water, the embryos burst their egg envelopes and emerge as free swimming forms. It is a curious and most important practical fact that though the ova possess great resistance to outside agencies, and are difficult to destroy, the free embryos are at once killed by even a small amount of decomposing matter present in the water containing them, or a very low percentage of any acid or so-called "germicide" substance.

The subsequent history of these ciliated larvæ has not as yet been satisfactorily worked out; but it is probable that they enter the bodies of certain fresh water mollusks, and there undergo certain morphological changes, finally leaving their shellfish hosts, to again become free swimming forms. In this stage, if taken into the human stomach with drinking water or otherwise, they quickly attain their proper habitat in the blood vessels, there rapidly mature, and, copulation having taken place, new broods of ova are produced and set free in the urine.

The *Bilharzia* seems to be confined to Africa, and it is found throughout the length and breadth of that continent. In Egypt it is especially common, and there gives rise to a most formidable disease. It is also abundant at the Cape of Good Hope, and there causes a frequently fatal form of hæmaturia. The disease has been contracted during a few days' stay in Africa, and has then been carried to India, England, and, I believe, to this country.

The *symptoms* produced by the blood fluke are as follows: Diarrhœa, colic, anæmia, and great prostration of the vital powers, combined with bloody urine, the latter often amounting to most alarming hæmorrhages. The presence of the peculiar pointed ova in the urinary secretion, of course, renders the diagnosis certain.

On post mortem examination terrible lesions are found to exist in the urinary organs and intestines; the mucous (inner) surface of the bladder is more or less covered with minute extravasations of blood, and in many instances there are thickenings, ulcers, and fungus-like growths covering its surface; portions of mucous membrane may even be separated from the remaining walls of the bladder. The kidneys are found enlarged and congested, and the intestines show changes similar to those found in the bladder.

The *treatment* of this disease is not at all satisfactory, patients either recovering without interference—through innate vitality, and the early death of the parasites—or becoming completely broken down in health, or dying in spite of all treatment. The indications are, to support the general strength, and to treat, so far as possible, the symptoms, especially the bleeding and local lesions.

The sanitary measures most likely to control *Bilharzia* disease are such as will keep the supply of drinking water free from all sewage contamination, or the use of only filtered water, or of that which has been boiled.

The development of the *Trematoda*—to which the *Bilharzia* belongs—is of the greatest interest. One of the most closely studied species is the *Distoma militaire*, the adult form of which inhabits the intestines of several species of water birds. The ova produced by this species pass out of the body of their host, and from each of them emerges a ciliated embryo. This embryo finally loses its cilia, and develops into a sac-like *redia*, which lives attached to the body of a water snail. Within the body cavity of the *redia* there now appear a number of vesicles, which ultimately develop into larvæ (*Cercariæ*) having long tails and a somewhat tadpole-like form. These burst their way through the wall of the *redia* and escape into the water, and after swimming about freely for a time these *Cercariæ* bore their way into the bodies of various water snails. Here they become encysted, and their tails drop off, and a crown of hooklets is developed. This form then remains quiescent until its molluscan host has the misfortune to be eaten by a water bird. In that case its enveloping cyst wall is digested, and the young *Distoma* makes its escape into the alimentary canal of its feathered bearer. It now gradually develops into a perfect adult *Trematode*, attaches itself by its hooklets to the intestinal wall, acquires sexual organs, and produces a fresh crop of ova to propagate its species.

The developmental cycle of the *Trematoda* varies considerably in different genera, but the above may be considered the typical series of morphological changes through which these parasites pass. The *Bilharzia hæmatobia* is, however, a very aberrant form, and probably varies widely in its metamorphoses from the other *Trematoda*.

The "water vascular system" is well developed in all the *Trematoda*; it consists of "a contractile sac, which opens externally and communicates with longitudinal vessels with contractile, non-ciliated walls, from which proceed non-contractile and ciliated branches which ramify through the body." The ciliated larva of *Bilharzia* has this system highly developed; in it the vascular canals consist of two main tubes which pursue a tortuous course longitudinally from head to tail, and give off in their passage several anastomozing branches. RALPH W. SEISS, M.D.

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The Most Recent Naval Battle.

Le Temps, Paris, notices an account of the fighting in the Min River, published in pamphlet form at Shanghai, China, by James F. Roche and L. L. Cowen, U.S.N., who were present during the action between the French and the Chinese. Aside from the detail of the forces engaged on both sides and the skill of the naval combatants, which give us no new information, there is, says *Le Temps*, one point which deserves special consideration. These officers state that the result of the fight in favor of the French fleet was due to its armament of revolving cannon and the superiority of its torpedo service. They consider that these are the only points upon which instruction may be gained from this action. "The power of revolving cannon," they say, "their inestimable value in naval engagements, and the importance of a well organized torpedo service were plainly visible to all naval people." Before the shower of shell fired by the Hotchkiss revolver cannon from the tops of the French vessels the enemy went down like grain before the scythe. Reliefs could not get on deck fast enough to fill the gaps in the ranks of the Chinese gunners. The little shells pierced the rails and bulwarks of the vessels, and their explosion spread death in all directions. The torrents of fire poured into the Chinese vessels were so murderous that it is safe to estimate that 800 men out of the 1,000 manning the Chinese squadron were killed.

The importance of the role of revolving cannon in naval engagements was as fully appreciated, also, by the English officers who witnessed the fight. It is scarcely necessary to state, says the *Temps*, that the French officers who made such brilliant work with these guns have made a most thorough report with regard to their value. Nevertheless, the lesson to be learned by this combat is that hereafter no vessel can go into action if the guns which it has mounted on open decks are not protected against the effects of rapid-firing guns. It is therefore necessary that every piece of artillery should be covered by a metal shield as a protection against rapid-firing guns; that the gunners should be equally protected, not against the effects of heavy projectiles, which would necessitate covering the vessel completely with armor, but against machine gun fire directed from the enemy's tops, which send in showers of projectiles whose explosion would render totally untenable the decks of most vessels.

The caliber of the Hotchkiss revolver cannon which formed the auxiliary armament of the French vessels is 1½ inches, and the length of bore 29 inches. They weigh 450 pounds, and fire a shell weighing 1 pound, with a bursting charge of three-quarters of an ounce.

Preliminary Trial of Strength of New York Police Candidates.

An examination of applicants for positions on the police force lately came off at Wood's gymnasium, this city. Eighteen candidates presented themselves. They were first put through the dumb-bell exercise and lifting of weights up to fifty pounds. After this they were required to run a mile, twenty-two laps of the gymnasium, in 7½ minutes. Some five failed to complete the time, but of the others many came in a minute and a minute and a half in advance.

They were then required to put on the gloves with the professor of the gymnasium, who occasionally got in a heavy blow to test the temper, and several of the competitors retired with a black eye and battered nose. Their strength was after this tested by pulleys.

The requirements of the commissioners were very fair and moderate, and nearly all the candidates, who were a very fine troop of young men, went through the ordeal satisfactorily.

A New Water Cooler.

The cooler consists of a revolving basket of wire gauze (something like an exaggerated squirrel's cage) surrounding an inner stationary vessel pierced with numerous small holes, through which the heated water discharged by the air pump of the engine finds its way into the revolving basket, to be thrown out in the form of fine spray to a distance of 20 feet on either side. The drops are received in the tank or dam; and in its rapid passage through the air, the water is sufficiently cooled to be again ready for injection into the condenser. The basket is about 3 feet in diameter; and it makes 300 revolutions per minute. The apparatus requires 3 to 4 indicated horse power to drive it; and will cool 300 gallons of water a minute. It is claimed that the driving power required is more than recovered in the increased power given to the engine through the greater perfection of the vacuum which is obtained in the condenser. The use of the apparatus also, of course, allows of great economy where water is taken from the town supply, or any other costly source. The patentees—Messrs. Bosse and Miller—give some particulars of a recent trial made with the apparatus. The temperature of the water going in from the hot well was 158° Fah., and it was discharged ready for use again at 106°. The minimum result was obtained with an inlet temperature of 138°, which was brought down to 98° —a reduction of 40°. The results obtained at a Bradford, England, mill (using town's water) in two succeeding weeks were: Without the appliance, 204,000 gallons of water used; with the cooler in operation, 160,000 gallons—a saving of 36,000 gallons per week.

Silk Cannon.

A German inventor proposes to wrap a steel tube with silk until a diameter is attained corresponding with the ballistic power which is required for the cannon. For any given diameter silk possesses a tenacity as great as that of the best tempered steel, and has the advantage of a superior elasticity. After the tube has been made it is centered upon a lathe which turns with a great angular velocity. Above and parallel with the tube are arranged a number of spools of silk, which cover the surface in the form of a helix, by means of guides, without leaving any space between the threads. When the desired thickness has been obtained, the silk is coated with gutta-percha or hardened caoutchouc, in order to preserve it from air and dampness. The silk being a bad conductor of heat, the gun can be fired very often without getting hot, and it is stated that it can be more easily managed, since its weight is only one-third as great as if it only were of steel.

Oxygen Inhalation for Phthisis.

Dr. Albrecht, of Neuchatel, has been experimenting on consumption patients in a hospital at Berne, Switzerland, with a view of ascertaining its effects upon the development of phthisis, and whether, by increasing the rate of organic combustion by this means, the bacterium of consumption would not be destroyed and eliminated from the system. The subjects were tuberculous patients, in whose expectoration the bacterium of phthisis had been discovered with certainty on several occasions. The patients were first submitted to an appropriate highly nutritious diet, consisting of milk and peptone, and twice a week they were weighed with great care. It was observed that as soon as the oxygen inhalations began the daily loss of weight was checked, and in some cases the weight increased, dyspnœa diminished, and the number of bacteria seen under the microscope appeared smaller.

Weight of Drops.

Boymond has lately published an interesting notice upon the weight of drops. It is well known that the weight depends upon the exterior diameter of the tube; the interior diameter having no influence except upon the velocity of flow. The nature of the liquid determines the weight, whatever may be the proportion of dissolved material that it contains. Boymond used a dropper of one-eighth of an inch diameter, and determined the weights by an extremely sensitive balance. The mean of his results gave: for 15 grains of distilled water, 20 drops; alcohol of 90°, 61 drops; alcohol of 60°, 52 drops; alcoholic tinctures from 60° to 90°, 53 to 61 drops; ethereal tincture, 82 drops; a fatty oil, about 48 drops; a volatile oil, about 50 drops; an aqueous solution, whether diluted or saturated, 20 drops; a medicinal wine, 33 to 35 drops; laudanum, about 33 to 35 drops.

A Bell Ringing Eagle.

For some weeks past the crew of the ferryboat at Cornwall, N. Y., on the Hudson River, have heard a mysterious ringing of a bell while crossing the river. It has occurred at a certain hour every morning, and the attention of the passengers has been called to it. Many theories were advanced to account for the mystery, and the superstitious thought it a bad omen. It was noticed that a large bald eagle regularly flew north at the hour when the ringing was heard, but as eagles are not supposed to have bell attachments, this fact did not seem to solve the mystery. A few days ago the fog on the river became so thick that it not only interfered with the progress of the ferry, but it also made it hard for the eagle to keep its usual course. The consequence was that the boat and the bird came close together in the middle of the river, and it was discovered that the bell whose strange ringing was regularly heard every morning was fastened about the neck of the eagle.

Gilding a Dome.

To many, the coating of so exposed a part of a building as a dome or roof with thin gold leaf would seem to be a waste of material; the first snow or hail storm would pierce and tear it to shreds. The fact that the gold defies the wear of the weather induces the belief that it is much thicker than the leaf used by sign painters, bookbinders, and makers of fancy, ornamental articles. But the fact is that the gold leaf is precisely the same—airy, fleecy, and capable of floating in air like a gossamer fiber.

The gilder of the dome of the capitol at Hartford, Conn., Captain Thomas F. Burke, says that his principal trouble in doing the work was from currents of air, the altitude being more than 200 feet from the ground, and the site of the building itself being one of the highest in the city. To do the work properly he constructed a movable canvas shield made to fit the curvature of the dome and its twelve radial ribs, not so much to shield the workmen as to prevent the leaf from being blown away. To cover this dome—an area of 4,100 square feet—there were used 87,500 leaves of gold, each three and three-eighths inches square, weighing, in the whole, three pounds avoirdupois. The total cost of the gold and the labor was $1,600.

Trade Names of Leather and Grades of Shoes.

There are, says the *Shoe and Leather Reporter*, thousands of retail shoe dealers and a large number of jobbers whose practical knowledge of leather, its wearing qualities and its adaptability to boots and shoes, is very limited, and it may profit them to learn something about it. Of sole leather there are two divisions, hemlock and oak, and general subdivisions; these are of hemlock, acid and non-acid, while of oak some is tanned with oak bark exclusively, and some with oak and hemlock combined. The latter is called union. Then there is buffalo, an inferior East India hide, tanned in hemlock. All of these are adapted to heavy boots, brogans, plow shoes, wax, kip, and split, pebble grain, and the heavier grades of calf boots. Union leather is used almost entirely in the manufacture of women's shoes of the finer qualities, slippers, sandals, Newports, and all low cut shoes and fine button boots. Manufacturers of calf and flesh split shoes for men's wear use union leather extensively. Of upper leather there are still greater varieties. Wax, kip, and split leather are used extensively in the manufacture of heavy boots, brogans, and plow shoes. Men's, boys', and youths' balmorals, button and strap shoes, are made of a light kip, which, being taken off a young animal, is designated as veal calf. A flesh split is a most desirable and salable article for fine shoes, and commands nearly as high a price as calfskins. Buff leather, so called because in finishing the grain is buffed off, is made largely from Western and New England hides, and is one of the leading lines of upper leather. A large number of shoe manufacturers are engaged in the buff shoe business, and the product finds a market in all sections of the country. Buff leather is adapted to men's button balmoral and congress shoes, and the finer and lighter weights are made into women's shoes, almost wholly in polish cut. Buff leather shoes are very popular in all large cities, New York city being a great market for them, and the South being large consumers. Buff leather is the strongest competitor with calfskins, and it requires an expert to tell the difference when the shoes are made up. Grain leather is made in pebble and glove finish for all light work, and in a heavy pebble for men's wear.

Glove grain is comparatively a new article, and the adaptability of it in the manufacture of fine shoes, and toppings for men's calf shoes, has made it extremely popular. It differs from pebble grain in that the surface is finished with all the care that is used in the finish of calfskins, and it is extremely difficult for a novice to tell the difference. The consumption of glove grain is increasing every season. Pebble grain is made both light and heavy for women's work. It requires a 2½ to 3 ounce weight for a fine polish-sewed shoe, while pegged and nailed work requires a 4 ounce grade. Very little grain leather is used, except for these styles of foot gear. For working women and girls the pebble or glove grain polish shoe which can be bought in the vicinity of $1 per pair is a most desirable and serviceable shoe, and the demand is generally brisk enough to keep what limited number of manufacturers there are of them busy. The heavy boot or shoe grain used in shooting boots, balmorals, Napoleon long boots, and such, is made largely in Chicago, and has an extensive sale in the East. For winter service there is no shoe that can excel the grain balmoral. It is neat in appearance, and durable. It is practically waterproof. Calfskins are made for all sorts of boots and shoes. They run all weights from twenty pounds to the dozen up to a heavy veal kip weighing one hundred and thirty, perhaps more. Calf goods are made in every conceivable quality and style from the lightest shoe—even slippers—to the heaviest boot, and in many shapes—button, congress, balmoral, strap shoes, low cut, etc. A great many calf boots have split backs. Glove calf is a soft finish, resembling a sheepskin on the unfinished side, and is used for toppings of shoes, fly button pieces, and such.

Sheep leather is largely used for shoe linings, and for vamps and quarters in very cheap shoes for women's wear. They are made in creams, pinks, russets, and white, alum, sumac, and bark tanned, and the consumption is immense. Kid and goat leather enters into the manufacture of ladies' work exclusively. Goat is made both in pebble and smooth finish, is used in the heavier grades of shoes, having its competitor in the pebbles, grain, or imitation goat, "so called." Kid leather is extensively used for all kinds of fine button and polish shoes, slippers, sandals, and all low cut women's shoes. During the past few years there have been many discoveries and improvements in the method of tanning these skins, and they are now made in *Siamang, Caracal, Koodoo, Dongola, daisy kid*, etc., all of which are practically the same. They are all designed for ladies' shoes. The demand for novelty is met by russet and colored alligator, and imitations of it, russet and red pebbles, mat kids, leopard, grain, moroccoes, and such, but all these have a comparatively limited sale, and the bulk of the goods sold are of the kinds enumerated above.

Quicksilver as a Preventive of Phylloxera.

John A. Bauer, of San Francisco, states that he has found a sure and cheap preventive of the ravages of the phylloxera. His remedy is half an ounce of quicksilver, mixed in particles too small to be distinguished under an ordinary microscope, with an equal weight of pulverized clay, in the soil of the hole in which the vine is planted. The cost for the mercury, at the present price, is a little more than a cent for each vine, or, as the vineyards are set out in California, from $7 to $10 an acre.

It is supposed that a dose of the mixture will protect the vine for at least twenty years; but proof upon that point can be furnished by time alone.

The clay that is selected as the cheapest vehicle for keeping the metal in its proper place (bringing it into contact with a greater surface of root, and preventing it from sinking down into the ground, as it would if left in large globules) should be free from grit, and may be mixed with the metal in a revolving barrel.

The remedy is simple; it can be prepared, assayed for general purposes, and applied without danger or technical skill; its efficiency can be tested without much delay or expense by any one who has phylloxera and a microscope.

Mexican Railways.

David B. Hunt, former assistant treasurer of the Connecticut River Railroad, who had been connected with the Mexican Central Railway since April, 1882, has returned home to Massachusetts for a brief stay, and has given some particulars of Mexican railroading to the Springfield *Republican*, which says:

Mr. Hunt went to Mexico when about 200 miles of the main line of the road from the city of Mexico to El Paso was completed, and watched the progress of construction until the connection of the two divisions was made last March. The number of men employed in the work was 15,000 or 20,000. The length of the road is 1,225 miles. The Southern division has a considerable grade, but the Northern division is remarkably even, as it runs through a level country and makes few curves. The road follows the table land through its whole length. The expenses of building for these reasons were comparatively light, and the road promises to be a liberally paying enterprise. The earnings for October were nearly $300,000, and one good passenger and freight train a day will more than pay expenses and interest. The time from El Paso to the city of Mexico is two days and three nights. The road depends mostly upon its through business, but has a paying local business between the city of Mexico and Zacatecas, a city of 65,000 inhabitants 24 hours' run to the north. The freight handled is almost entirely from the United States, and the return trade is very small in comparison. Machinery has thus far been the principal import over the line. There has been considerable furniture and a great deal of beer, which is shipped by the car load from St. Louis, and which is eagerly welcomed by the Mexicans, as they have heretofore been compelled to pay $1 a bottle for it. There is not much to come out of Mexico as yet except minerals.

The passenger business is excellent, especially between Mexico and Zacatecas. It is found impossible to have a single class of carriages, as in this country; and the English system of three classes has been adopted. The first class carriages are similar to the ordinary cars in use on our railways. The second class are plain, with wooden seats and no cushion. The third class have four rows of seats running lengthwise. The fare for the respective classes is 3 cents, 2 cents, and 1½ cents a mile. Two-thirds of the passengers come from the lowest class. These are mostly Indians, half-breeds, and people of the sort that the others will associate with on no condition. The Pullman cars in use on the road are said to be the richest to be found on the continent. The conductors are all Americans, but the rest of the train men are Mexicans. Every train is furnished with an interpreter. Two side lines are now being built, one from Tampico westerly through San Luis to the main line; the other from the main line to the city of Guadalajara, and thence to San Blas on the Pacific coast. When completed, the total length of the road will be about 2,000 miles. The principal other line in Mexico is the Vera Cruz road, which is one of the best made in the world, and has long been famous for the beauty of the scenery along its line. The Mexican Central road, however, seems likely to get most of the business from this country, as it can take freight from New Orleans to the city of Mexico at a less rate than the tariff of the other road from Vera Cruz to Mexico. Besides, the exposed condition of the harbor of Vera Cruz and the unhealthy atmosphere of the town are great hinderances to its progress or to the success of any railroad line leading out of it. The growth of Mexico at present is much slower than it should be, considering the richness of its natural resources. The laws are crude and antiquated. One especially, which allows taxation only on cultivated land, is inimical to all agricultural progress. The business men of the city of Mexico are enterprising, but as they are almost entirely Germans and Frenchmen, Americans have only third choice in the market. Indeed, the class of Americans in the city is low as a rule. One great advantage of the country is its equable climate, the temperature varying little from 60 or 70 degrees the year round. This evenness of temperature, however, is not of so great value to the railroads in the preservation of their rolling stock as it would be if the direct beating of the sun's rays upon the cars did not shrink and split them. Mr. Hunt expresses great confidence in the good results that will follow the inauguration of the progressive government of President Diaz.

Self-purification of Sewage Contaminated Rivers.

Some investigations have been carried out by Herr Hulwa on the water of the river Oder before it entered and after it had passed through the city of Breslau, receiving in its transit the sewage of the city; and the results thus obtained may be commended to the consideration of those scientific alarmists who declaim so forcibly against the contamination of rivers by sewage, etc. Immediately after leaving the city, the self-purification, by the combined action of the oxygen of the air and of vegetable and animal life in the stream itself, was very marked; the impurities diminishing so rapidly that at a distance of less than nine miles from the city the water was as pure both to chemical and microscopical tests as when it entered it. The author considers it a mistake to forbid the outflow of sewage into rivers, provided the outfall is below the city, and the rapidity and volume of the stream are sufficient to carry the sewage to such a distance as will allow the operation of the natural causes of purification.

Artificial Gutta Percha.

The following is from a German patent, No. 20,939, for a method for the manufacture of gutta percha: About 50 kilos of powdered gum copal, and from 7½ to 15 kilos of flowers of sulphur, are under continual agitation heated in a boiler with double the quantity of turpentine, or with from 55 to 62 liters of petroleum, to a temperature of 126 to 150 deg. C. till completely dissolved. The mixture is then allowed to cool down to about 38 deg. C., when a solution of 3 kilos of caseine is added, the latter being dissolved in weak ammonia with the addition of a small quantity of alcohol and wood spirit. The mixture is now heated for a second time to the same temperature until it assumes the consistency of a thin fluid. It is then boiled with a solution containing from 15 to 25 per cent of tannic acid—galls of catechu—to which ½ a kilo of ammonia has been added. After having been boiled for several hours the mass is allowed to cool, washed with cold water, and kneaded out in hot water. After this treatment it is rolled out and dried.

Give Water to Infants.

A physician of the New York Nursery and Child's Hospital believes, from his practice, that infants generally, whether brought up at the breast or artificially, are not supplied with sufficient water, the fluid portion of their food being quickly taken up, and leaving the solid too thick to be easily digested. In warm, dry weather, healthy babies will take water every hour with advantage, and their frequent fretfulness and rise of temperature is often directly due to their not having it. A free supply of water, and restricting the frequency of nursing, has been found at the nursery to be a most effectual check in cases of incipient fever, a diminished rate of mortality and marked reduction in the number of gastric and intestinal complaints being attributed to this cause. In teeth cutting water soothes the gums, and frequently stops the fretting and restlessness universal in children at this period.

The Amyl-Acetate Light.

Dr. Bunte has recently described the Hefner-Alteneck standard of light before the German Gas and Water Works Managers' Society. This standard consists of a lamp burning amyl-acetate by means of a simple cotton wick. The designer has deliberately adopted a lamp with a wick, because he has found, on experiment, that a lamp without a wick is a comparatively complicated and troublesome affair. The height of the lamp-flame is, however, fixed, because experience shows that with a known diameter and height of flame the illuminating power is constant; and this is true of all descriptions of luminous material, whether paraffin, oil, or candles. The standard is defined as being the light given by a freely burning flame of amyl-acetate, burning to a height of 40 mm. from a solid round wick contained in a tube of German silver, 8 mm. in diameter internally, and 8·3 mm. in diameter externally, standing 25 mm. above the body of the lamp, and lighted 10 minutes before the observation is made. The power of the lamp is equal to the average of an English standard candle with a flame 43 mm. high. The lamp itself is very simple, without a chimney; and the height of the wick is regulated by a cog mechanism of the most ordinary kind. An upright rod with a projecting wire stands upon the lamp to gauge the height of the flame. The amyl-acetate is sold in Berlin at 6 marks the kilogramme delivered.

ENGINEERING INVENTIONS.

A car coupling has been patented by Mr. Salathiel T. Northcutt of Brooks, Oregon. This invention provides an interchangeable link and hook, with special devices to control the working parts of a coupling, from the top of the car or from the ground on either side, to secure it against coupling automatically, or to set the coupling to couple automatically.

A spark arrester has been patented by Mr. James A. Stout, of Belleville, Ill. This invention covers special combinations of parts, including an inner uptake and water receptacle, an outer pipe or duct arranged to produce a down draught into and up through the water receptacle, a hinged or raising and lowering screen cover at top of the outer pipe, and inner spark deflector arranged to move up and down with it.

MECHANICAL INVENTIONS.

A knitting machine has been patented by Mr. Isaac W. Lamb, of Parshallville, Mich. This invention relates to machines in which the needles are placed in two rows opposite each other in planes at angles of about forty-five degrees with the horizon, and its object is to economize the construction and increase the facility of operating the machine.

AGRICULTURAL INVENTIONS.

A rotary cultivator has been patented by Mr. Thomas B. Nutting, of Morristown, N. J. It is constructed with dish-shaped disks attached to shafts inclined from each other and journaled to frames, so when the machine is drawn forward between two rows of plants the disks will be revolved by the resistance of the soil, and cut up and destroy the grass and weeds while moving the soil to and around the plants.

A fertilizer distributing attachment for carts has been patented by Mr. John A. Mitchener, of Selma, N. C. The cart or vehicle body has a hopper arranged therein, with extensions at the upper end to fold down thereon, and beneath the discharge opening in the bottom of the cart body is a spout to receive the fertilizer and conduct it to the ground, the whole being designed for the distribution of fertilizers automatically as the cart is driven over a field.

MISCELLANEOUS INVENTIONS.

A miner's implement has been patented by Mr. Isaac A. Martin, of Ouray, Col. The invention covers a combination tool to be used for cutting fuses, setting caps, and digging holes in powder charges or giant powder candles.

A catarrh remedy has been patented by Mr. Rufus H. Scott, of Centralia, Ill. It consists of chloroform, camphor, chloral hydrate, glycerine, and carbolic acid, in specified proportions, and to be mixed and used in a certain described manner.

A curry comb has been patented by Mr. David B. Weightman, of Grand Rapids, Mich. The body and handle are of peculiar shape, so that, besides the teeth of the comb, a metal or rubber-faced blade may be used for rubbing down horses and stock.

A washboard has been patented by Messrs. Henry Luther and Justus P. Luther, of Berlin, Wis. This invention is designed to provide more substantial washboards than those heretofore made, and with different forms of corrugations on the different sides of the board for different kinds of fabrics.

A combined glove stretcher and measure has been patented by Mr. Augustus Traver, of New York city. It combines a fixed clip and a sliding clip, between which clips the hand is placed for measuring, with a glove stretcher on which a glove measure or scale is fixed, and provides especially for measuring the hand across the knuckles.

A necktie fastening has been patented by Mr. Gibbard R. Hughes, of London, Middlesex Co., England. The invention consists of a piece of sheet metal cut and bent into a special form, and is one of a class of devices used instead of button holes or loops to attach one article of clothing to another by means of buttons or studs.

A paper barrel has been patented by Mr. James Cosgrove, of Flatbush, N. Y. The shell is made in one piece, with flaring slits in its side edges to give a taper to the end parts, shoulders in these edges to form seats for the heads, and the shell and heads being fastened together by hoops applied in the ordinary manner.

A spring clasp for horse collars has been patented by Mr. Stephen E. Burghdorf, of Geneva, N.Y. This invention provides a special combination and arrangement of parts forming a practical clasping device to take the place of straps and buckles, so the collar may be easily put on and removed, and is simple and inexpensive.

A wheat cleaner has been patented by Mr. Solomon Bernheisel, of Green Park, Pa. A cylinder and shell are made to revolve in the same direction, one faster than the other, both sides of the kernel of grain being acted on at the same time, the drum being armed with yielding brushes to effect a more thorough scouring than any rigid fixtures would effect.

A necktie has been patented by Mr. Edwin D. Smith, of New York city. A shield is made of sheet metal, hard rubber, or similar material, with wings on its rear surface for securing the fabric, and a pivoted tongue or latch for locking the shield on the collar button, ribbons or bands of fabric being secured to the shield in such manner as to expose part of the front.

A tension for corn planter check wires has been patented by Mr. William E. Rawlings, of Lynnville, Ill. It is made with a stock having a longitudinal perforation with a spring, a sliding bar with a recess and anchor wire, a sliding bar with forked hook to receive the check wire, teeth to engage with a catch plate, and an operating cord and guide pulley, so the check wire can be put under uniform tension.

An anchor support and tripper has been patented by Mr. Rufus P. Trefry, of Bridgewater, Nova Scotia. It is an instrument to fasten to the rail of a vessel to hold the fluke of an anchor, and so it may conveniently be thrown from the rail as required, the stock of the anchor coming against the hull of the vessel when the fluke is on the rail; it is a simple and inexpensive device, which may be used with any anchor.

A needle cabinet has been patented by Mr. Thomas H. Harper, of Redditch, Worcester County, England. It is divided into compartments, with a slide on the bottom of each, the slide having a longitudinal recess and a slot in its bottom, through which a pin or screw is passed into the bottom of the compartment, the invention being an improvement on a former patented invention of the same inventor.

A saw has been patented by Mr. Jasper L. Purple, of Owego, N. Y. It has a longitudinal slot at right angles to the straight inner edge of the handle, through which slot a set screw passes, which can be adapted to any desired angle, one edge of the slot having a graduated angle scale, while the lower inner corner edge of the handle is adapted to serve as a rest for a straight edge, rule, or similar instrument.

A ditching machine has been patented by Mr. Samuel P. Mason, of New Vienna, Ohio. The object of the invention is to facilitate the opening of tile ditches, and promote convenience in controlling and regulating ditching machines, the cutters and shares being so constructed that they can be adjusted to work at any desired depth in the ground, and readily raised and lowered to regulate the grade of the ditch.

A mechanical movement has been patented by Messrs. James K. Lowe, George M. Westgate, and John Banks, of Logan City, Arizona Territory. The invention relates to the "trammel" or slotted disk movement for converting rotary into reciprocating motion, and consists principally in such construction of the disk that a small ball or circular plate may be used for bridging the cross heads across the slots.

A device for converting motion has been patented by Mr. George H. Caughrean, of Raymore, Mo. Combined with a shaft are two clutch disks, mounted rigidly thereon, with two clutch pulleys loose between the disks, cables or ropes being wound in reverse directions on the pulleys, the ends of the ropes secured in end pieces of a sliding frame, so when the frame is reciprocated the shaft is revolved from the clutch pulleys, which act on the clutch disks on the shaft.

A windmill has been patented by Messrs. George W. Orcutt and James A. Wood, of Los Angeles, Cal. The principal object of the invention is to make a mill which shall be self-regulating against variations of centrifugal force and wind pressure, the wind striking the concave faces of the fans, causing the wheel to revolve, and when the wheel reaches a certain limit the centrifugal force acting to close the fans independently of the action of the wind thereon.

An elevator has been patented by Mr. Walter L. Folstead, of Richmond, Va. It is for carrying persons or merchandise, and provides means whereby a series of cars attached to an endless chain or belt may be adapted to carry loads both up and down at the same time; also means for connecting and disconnecting with a continuously running power to stop the elevator at will, to hold it, and to work it temporarily by hand power when machine power may not be available.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDETS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) H. J. C. asks for an effective way of taking grease spots out of ground glass. A. Use a concentrated solution of caustic alkali or pearl ash. Ammonia or even alcohol may perhaps be sufficient.

(2) F. S.—China blue, or royal smalts, is the crude oxide of cobalt, sometimes called zaffer, ground with an equal weight of potash and about eight times its weight of feldspar, the mixture submitted to fusion in a crucible, and when cold reduced to an impalpable powder. Used to paint pottery, and also as a blue pigment.

(3) C. A. S. asks how to make bay rum strong, same as barbers charge five cents extra for. A. Saturate a 4 ounce block of magnesium carbonate with oil of bay; pulverize the magnesium carbonate, place it on a filter, and pour water through it until the desired quantity is obtained, then add alcohol. The quantity of water and alcohol depends on the desired strength and quality of the bay rum.

(4) J. H. asks how the plumbago used in the manufacture of lead pencils is hardened or made into a hard form. A. The plumbago is mixed with clay in various proportions according to the hardness required, and baked.

(5) J. E. K. writes: I have a small propeller engine which I have made to go into a small boat; the engine is 1½ inches, and I would like your idea of a boiler, and the mode of heating the same. A. Your boiler should have about 16 or 18 feet heating surface. Use anthracite (chestnut) coal or clean coke.

(6) T. H. writes: In firing a cannon ball against a board fence, which is through the first—the ball or the hole? A. When the largest part of the ball has passed through the fence, the hole is complete, and this would occur before all of the ball had passed through the fence.

(7) T. V. H. asks for a recipe for transparent paints that can be used for coloring glass, red and green being the colors. A. Many of the aniline colors are soluble in alcohol, with which varnishes are prepared, so that by dissolving a little aniline of the desired shade with the varnish, and using it very thin, we should think that you could accomplish your object.

(8) C. W. S. asks what ingredients are used to make the blackest of writing fluid, without fading away afterward, on white paper. A. The following ink is probably the most durable:

Bruised galls	4 parts	or 40 lb.
Gum	1 "	or 10 lb.
Iron sulphate	1 "	or 9 lb.
Soft water	45 "	or 45 gals.

Macerate for three weeks, employing frequent agitation. Also see the recipes given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157.

(9) J. McK. asks the amount of pure starch per bushel ordinary corn will yield, also a few notes on its general manufacture. A. The flat yellow American maize contains 58·50 per cent of starch, while the flat, white, and round yellow varieties contain about 54·75 per cent. For further details we must refer you to Van Wagner's Practical Treatise on the Manufacture of Starch Glucose, Starch Sugar, and Dextrine, $3.50.

(10) J. C. writes: I have a steam launch 22 feet long, 5·3 beam, 2·0 draught, 4 horse boiler, engine 4x5 inches stroke, 250 revolutions per minute, 100 pounds of steam. (1) Give me diameter and pitch of screw. A. Screw 28 inches diameter and 39 inches pitch, 3 blades. 2. What speed can I expect? A. Seven and a half to eight miles per hour. 3. Now, I want to use salt water in boiler; give me some good reasons for not using. A. You will necessarily have a tubular boiler, which it is troublesome to clean. Salt water will rapidly deposit lime and salt (except blowing off is resorted to, which is not economical), which you will be unable to get off, and the result, a burned boiler. 4. Which is best—a donkey pump or an injector as a boiler feeder? Steam valve to engine is a ¾ globe valve. I only open it one-sixth of a turn, and have repeatedly made 8 miles per hour. I must have a screw proportionate to power of engine. A. An injector is most economical, but is very sensitive and requires great care. We should think in your case a donkey pump preferable.

(11) W. S. & Co., write: 1. We inclose you a copy of analysis of chalybeate water on our place, and would like to know what effect it would have on our steam boilers. A. Probably the chalybeate water may be safely used in steam boilers, but the question had better be submitted to a good chemist. 2. Would it be better than our river water, which is composed principally of limestone water, and gets muddy every time it rains hard? A. The river water when muddy might be filtered; the lime might be disposed of in a great degree, by passing the water through a suitable heater before it enters the boiler.

(12) Subscriber writes: You recommended, for ebonizing wood, to pour two quarts boiling water over one ounce powdered extract of logwood, and when solution effected, add one drachm yellow chromate of potassium. I tried your recipe, but without success. Is not the proportion of water much too great as compared to the other ingredients? A. To ebonize wood, take 4 ounces shellac, 2 ounces borax, and ½ gallon water, boil until dissolved, then add ¼ ounce glycerine. To this mixture add sufficient of the water-soluble aniline black.

(13) E. B. F. desires a recipe for a cement that will join together the parts of a fancy iron stand. A. Fuse together equal parts of gutta percha and pitch; use hot. A stronger cement consists of ammonium chloride (sal ammoniac), 2 ounces; flowers of sulphur, 1 ounce; iron filings or borings, 5 pounds to 12 pounds; with sufficient water to mix.

(14) R. P. P. asks the ingredients for making the "gilding compound" which is sold in the stores. There are two bottles, one containing the liquid and the other the powder. A. The powder is gold bronze or brass ground up very fine, and the liquid common size diluted. The London gold paint, is one of the best qualities used, and comes in sixteen shades. You will find it more satisfactory to purchase the article than to make it.

(15) J. W. W. asks (1) as to the best method or process of preparing, sensitizing, and fixing ordinary plain paper for printing from a negative in black on a dead white ground. A. Dip the paper into a solution of ammonium chloride, then float on a silver bath, which will form silver chloride. 2. How to make liquid tin foil if it is possible, in other words, a cold metallic liquid that will set or harden in half an hour or less, after being poured out or used? A. A silvering solution of mercury is the only article that seems to cover your wants.

(16) R. H. M. asks what is the highest degree of heat at which water can successfully be pumped from a well, fourteen feet deep, by an ordinary double acting piston pump. A. This depends entirely upon the position of the pump chamber. If the pump is at the bottom of the well, so that the water will flow freely to the pump chamber, boiling water may be pumped. If it is above the water 2 or 3 feet, 170° is about the limit. If the pump is 14 feet above the water, you cannot rely upon service with the water above 150°.

(17) C. E. B.—You will find in Notes and Queries in recent issues of the SCIENTIFIC AMERICAN, full information on plating cutlery with white metal. The alloy used is block tin with a small percentage of antimony added. The articles must be cleaned from all grease by means of a solution of caustic potash; they should then be scoured with washed emery, and thoroughly washed; they should then be rubbed over with soldering fluid, and dipped into the melted metal. To prevent oxidation of the surface of the metal, it should be covered with wax or tallow. For full information on electro-plating, consult SUPPLEMENT, No. 310.

(18) H. U. writes: While at breakfast this morning, I was puzzled at hearing a sharp click; shortly after, on lifting a tumbler about half filled with milk, and a teaspoon standing in it, I was surprised to see the bottom remain on the tablecloth and the milk run out. The glass had broken close to the bottom—a clean break. The glass was three-sixteenths inch thick where it broke; as the frost or heat had not anything to do with it, I am puzzled to know the cause. A. The glass of the tumbler was probably under constant strain from the time it had been made, due to imperfect annealing, so it required only a slight change of temperature or peculiar conditions of the atmosphere to increase the strain sufficiently to cause the glass to break.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted,

December 23, 1884,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Animal trap, C. Hall 309,781
Auger, post hole, I. Robinson 309,803
Barrel and barrel head attaching device, A. L. Johnson 309,786
Barrel attachment, Hill & Peltier 309,544
Bed clothes holder, I. G. Bower 309,687
Bed, wardrobe, E. Doring 309,530
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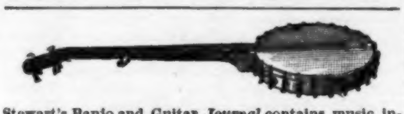

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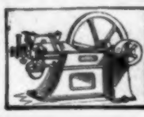

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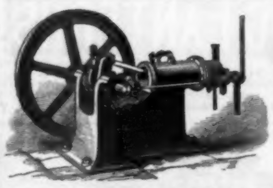

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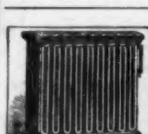

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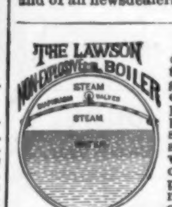

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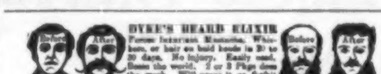

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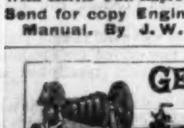

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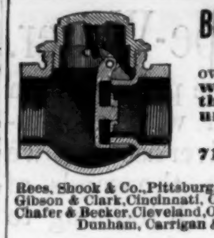

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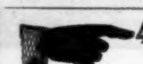

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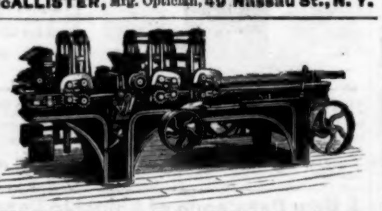

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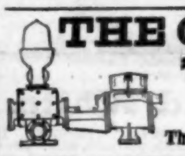

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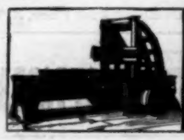

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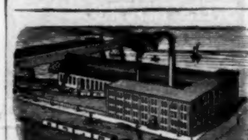

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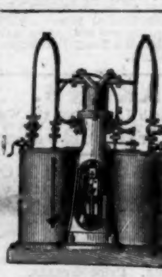

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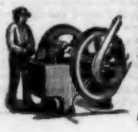

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